Zoological Studies **59:** 8 (2020)
doi:10.6620/ZS.2020.59-08

Zoological Studies

Open Access

A New Genus of Oak Gall Wasp, *Striatoandricus* Pujade-Villar (Hymenoptera: Cynipidae: Cynipini) from America with Descriptions of Two New Mexican Species

Víctor Cuesta-Porta[1,*], Miquel A. Arnedo[1,2], David Cibrián-Tovar[3], Uriel M. Barrera-Ruiz[3], Rosa D. García-Martiñón[4], Armando Equihua-Martínez[4], Edith G. Estrada-Venegas[4], Ricardo Clark-Tapia[5], Silvia Romero-Rangel[6], and Juli Pujade-Villar[1,*]

*[1]Departament de de Biologia Evolutiva, Facultat de Biologia, Universitat de Barcelona, Ecologia i Ciències Ambientals, Avda. Diagonal 643. 08028-Barcelona (Catalonia), Spain. *Correspondence: E-mail:vcuesta@ub.edu (Cuesta-Porta); jpujade@ub.edu (Pujade-Villar) E-mail: marnedo@gmail.com (Arnedo)*
[2]Insitut de Recerca de la Biodiversitat (IRBio), Universitat de Barcelona
[3]División de Ciencias Forestales, Universidad Autónoma Chapingo, Km 38.5 Carretera México-Texcoco. Chapingo, Estado de México, México. E-mail: dcibrian48@gmail.com (Cibrián-Tovar); umbr757@gmail.com (Barrera-Ruiz)
[4]Instituto de Fitosanidad, Colegio de Postgraduados, 56230 Montecillo, Texcoco, Estado de México, México. E-mail: delisgama@live.com.mx (García-Martiñón); equihuaa@colpos.mx (Equihua-Martínez); estradae@colpos.mx (Estrada-Venegas)
[5]Universidad de la Sierra Juárez, Instituto de Estudios Ambientales. Avenida Universidad S/N, C.P. 68725, Ixtlán de Juárez, Oaxaca, México. E-mail: ricardo.clark2013@gmail.com
[6]Universidad Nacional Autónoma de México, Facultad de Estudios Superiores Iztacala, Laboratorio de Ecología y Taxonomía de Árboles y Arbustos, Av. de los Barrios 1, Los Reyes Iztacala. Tlalnepantla de Baz, Estado de México, México. E-mail: sromero@unam.mx

Received 17 December 2019 / Accepted 22 February 2020 / Published 26 March 2020
Communicated by Shen-Horn Yen

A new genus of cynipid oak gall wasp, *Striatoandricus* Pujade-Villar (Hymenoptera: Cynipidae: Cynipini), is described. *Striatoandricus* gen. nov. includes four previously described species, *Andricus nievesaldreyi* n. comb., *A. georgei* n. comb., *A. maesi* n. comb., and *A. barriosi* n. comb., which induce pubescent leaves or twig galls on *Quercus* belonging to *Quercus* section. Two new species from México are also described: *S. cuixarti* Pujade-Villar n. sp. and *S. sanchezi* Pujade-Villar n. sp. in *Quercus* section. Descriptions of the genus and diagnostic characters, including DNA sequence data, are presented. This new genus is supported by both morphological and molecular data.

Key words: *Andricus*, *Striatoandricus*, America, gall wasps, *Quercus*.

BACKGROUND

Gall wasps are members of the superfamily Cynipoidea, a major lineage of predominantly parasitoid wasps within the Hymenoptera (Ronquist 1995; Ronquist 1999; Ronquist et al. 2015). All gall wasps are phytophagous, obligate parasites of plants, and either induce their own galls in plant tissues or develop as inquilines within the galls induced by other gall wasps.

Since the monographies of Dalla Torre and Kieffer (1910) and Weld (1952), the number of genera has changed. Melika and Abrahamson (2002) reviewed the generic limits and recognized 26 valid genera of oak gall wasps (Cynipini). In the last 15 years, the generic knowledge has changed significantly. There are currently 41 valid genera of Cynipini, and they are distributed in America Holarctic, Neotropic, Eastern Palaearctic and Oriental region (Nicholls et al. 2018).

Citation: Cuesta-Porta V, Arnedo MA, Cibrián-Tovar D, Barrera-Ruiz UM, García-Martiñón RD, Equihua-Martínez A, Estrada-Venegas EG, Clark-Tapia R, Romero-Rangel S, Pujade-Villar J. 2020. A new genus of oak gall wasp, *Striatoandricus* Pujade-Villar (Hymenoptera: Cynipidae: Cynipini) from America with descriptions of two new Mexican species. Zool Stud **59:**8. doi:10.6620/ZS.2020.59-08.

With regard to America, since the revision of Melika and Abrahamson (2002), four genera have been re-established: *Erythres* Kinsey (Pujade-Villar and Melika 2014), *Femuros* Kinsey (Pujade-Villar and Ferrer-Suay 2015), *Dros* Kinsey (Pujade-Villar et al. 2017) and *Sphaeroteras* Ashmead (Pujade-Villar et al. 2018); and seven new genera have been described: *Kinseyella* Pujade-Villar and Melika (Pujade-Villar et al. 2010), *Zapatella* Pujade-Villar and Melika (Pujade-Villar et al. 2012a), *Coffeikokkos* Pujade-Villar and Melika (Pujade-Villar et al. 2012b), *Kokkocynips* Pujade-Villar and Melika (Pujade-Villar et al. 2013), *Barucynips* Medianero and Nieves-Aldrey (Medianero and Nieves-Aldrey 2013), *Melikaiella* Pujade-Villar (Pujade-Villar et al. 2014) and *Protobalandricus* Melika, Nicholls and Stone (Nicholls et al. 2018). Despite those contributions, the generic limits of Cynipini remain unclear. Some old genera in the American region need to be revised, such as *Andricus* Hartig, *Callirhytis* Förste, *Disholcaspis* Dalla Torre and Kieffer and *Neuroterus* Hartig.

Here we describe a new American genus morphologically similar to *Andricus*, although not closely related phylogenetically, according to molecular data.

MATERIALS AND METHODS

Specimen collection

The studied materials were collected in México and Nicaragua and deposited in the following institutions: Barcelona University (UB, Barcelona, Catalonia; curator J. Pujade-Villar), Plant Health and Molecular Biology Laboratory (PHMBL, Budapest, Hungary; curator G. Melika), Universidad Autónoma Chapingo (UACh, Estado de México, México; curator D. Cibrián-Tovar), CP (Colegio de Postgraduados, Campus Montecillo, Texcoco, México; Curator A. Equihua); American Museum of Natural History (AMNH, New York, USA; curator J. M. Carpenter); and U.S. National Museum of Natural History (USNM, Smithsonian Institution, Washington, DC, USA; curator M. Buffington). Most of the specimens were preserved dry, but some adult wasps were preserved in 99% ethanol for molecular analysis.

Morphological descriptions

We followed the current terminology for morphological structures (Liljeblad and Ronquist 1998; Melika 2006). Abbreviations for the forewing venation according to Ronquist and Nordlander (1989) and cuticular surface terminology was extracted from Harris (1979). Measurements and abbreviations used here include: F1–F11, 1st and subsequent flagellomeres; POL (post-ocellar distance) is the distance between the inner margins of the posterior ocelli; OOL (ocellar-ocular distance) is the distance from the outer edge of a posterior ocellus to the inner margin of the compound eye; LOL, the distance between lateral and frontal ocelli. The width of forewing's radial cell was measured from the margin of the wing to the Rs vein.

The SEM pictures were made by the first author using a field-emission gun environmental scanning electron microscope (FEI Quanta 200 ESEM) for hard-resolution imaging without gold-coating the specimens. Gall images were taken by the first author with a Canon digital camera PowerShot SX510 HS, then processed on Adobe Photoshop CS3. Adult images were taken by Irene Lobato-Vila via Olympus SC30 camera, coupled to Olympus U-CMAD3, adapted to stereomicroscope Olympus SZX10 and combining multiple photographs with a program for image processing and stacking, Helicon Focus 6.2.2.

Molecular analysis

We assembled DNA data for 20 taxa representing the Cynipini tribe. The dataset was formed by 10 *Andricus* species (including 4 specimens with sculptured metasoma belonging to *A. georgei* and *A. nievesaldreyi*) and 6 additional genera: *Plagiotrochus*, *Biorhiza*, *Cynips*, *Disholcaspis*, *Dryocosmus*, and *Trigonaspis*. Previous phylogenetic treatments revealed *Plagiotrochus* as the sister group to the remaining Cynipini (Ronquist et al. 2015). Sequences from *Diplolepis rosae* (Diplolepidini) were included as the outgroup. Three molecular markers were used for the phylogenetical analyses: the mitochondrial gene for the cytochrome oxidase subunit 1 (*COI*), the mitochondrial gene for the cytochrome *b* (cyt*b*), and the nuclear gene for the large ribosomal subunit (28S). Sequences from the *Andricus* with sculptured metasoma were obtained in the present study. The remaining sequences were downloaded from the GenBank database (Benson et al. 2012) (Table 1).

The DNA extraction was performed with Speedtools tissue DNA Extraction Kit (Biotools). Each PCR mix consisted of 0.2 µl Taq polymerase (MyTaq™ DNA Polymerase), 0.4 µl MyTaq™ Red Reaction Buffer, 0.4 µl each primers at 10 µM, 2 µl of DNA, and water to a total volume of 20 µl. Cycling conditions were 94°C for 5 minutes, followed by 35 cycles of 94°C for 30 seconds, 45°C for 35 seconds, and 72°C for 45 seconds with a final extension at 72°C for 5 minutes. The primers used were: L1490 and H2198

(Folmer et al. 1994) for *COI* (also see Lee et al. 2018 for use in another insect taxon); CB1 and CB2 (Jermiin and Crozier 1994) for cytb; and 28SD2F (Campbel et al. 2000) and 28SB (Whiting et al. 1997). Sequencing was conducted at Macrogen through ABI3730XL DNA Sequencer using the Sanger method.

Each gene fragment was aligned independently using the software MAFFT online version 7 (Katoh et al. 2002). Alignment were subsequently edited with MEGA7 (Kumar et al. 2016) and concatenated with BioEdit (Hall 1999). Phylogenetic analyses were conducted on the concatenated dataset in both Bayesian and maximum-likelihood frameworks using the software MrBayes v.3.2 (Ronquist et al. 2012) and RaxML v.7.0.3 (Stamatakis 2006), respectively. The best partition scheme and corresponding evolutionary model were inferred with PartitionFinder2 (Lanfear et al. 2016). The best partition was separating both mitochondrial genes by the three codon positions and a single partition for 28S, and the model GTR + I + G was the most suitable for all three genes. Two independent chains of 10 million generations each were set for the Bayesian analysis; and, for the likelihood analysis, a rapid bootstrapping of 1000 replicates followed by a search for the best scoring tree. Both analyses were run remotely on the CIPRES Science Gateway (Miller et al. 2010). Correct mixing, chain convergence and the number of burn-ins per generation were assessed with the help of TRACER (Rambaut et al. 2018).

The aim of this analysis was only to check the currently species included in *Andricus* with sculptured metasoma to test whether or not they are true *Andricus*.

RESULTS

Striatoandricus Pujade-Villar, new genus

(Figs. 1–10)

urn:lsid:zoobank.org:act:9F4FF2CD-1674-4C63-AE7F-543113BD0C99

Type species: *Andricus georgei* Pujade-Villar 2011

Etymology: The genus is named after the special sculpture of its metasomal segments and its original assignment of (and morphological similarity to) oak gall wasp genus *Andricus*.

Gender: Masculine.

Diagnosis: Only asexual females are known. *Striatoandricus* gen. nov. belongs to the group of genera which the transscutal articulation is present and the asexual females are fully-winged; in addition, the mesoscutum never has transversal carinae neither rugae, the hind femora have no lobe in the posterior margin, the malar sulcus is absent, the ventral spine of

Table 1. Sequences used in the molecular analyses separated by species and gene. Codes are from GenBank Database and published references

Species	*COI*		Cyt*b*		28S	
	Code	Reference	Code	Reference	Code	Reference
Diplolepis rosae	JN252338	Kohnen et al. 2012	AF395136	Rokas et al. 2002	AF395157	Rokas et al. 2002
Andricus caputmedusae	DQ012619	Ronquist et al. 2015	DQ217990	Stone et al. 2009	DQ201496	Stone et al. 2009
Andricus coriarius	DQ012620	Ronquist et al. 2015	AF539556	Rokas et al. 2003b	DQ012579	Ronquist et al. 2015
Andricus kollari	AF395176	Rokas et al. 2002	AF242763	Stone et al. 2001	AF395156	Rokas et al. 2002
Andricus lucidus	JQ417120	Stone et al. 2012	JQ416351	Stone et al. 2012	DQ012582	Ronquist et al. 2015
Andricus mayri	DQ012624	Ronquist et al. 2015	AJ228465	Stone and Cook 1998	-	-
Andricus pictus	DQ012625	Ronquist et al. 2015	DQ217997	Stone et al. 2009	DQ012583	Ronquist et al. 2015
Andricus quercustozae	JQ417122	Stone et al. 2012	AY157293	Rokas et al. 2003a	EU552445	Stone et al. 2009
Biorhiza pallida	AY368931	Nylander et al. 2004	AF339628	Rokas et al. 2001	AY368957	Nylander et al. 2004
Cynips quercus	DQ012638	Ronquist et al. 2015	JQ416454	Stone et al. 2012	DQ012596	Ronquist et al. 2015
Cynips quercusfolii	JQ417130	Stone et al. 2012	DQ218012	Stone et al. 2009	DQ201481	Stone et al. 2009
Disholcaspis quercusmamma	-	-	KF554464	McEwen et al. 2014	KX683675	Nicholls et al. 2017
Dryocosmus cerriphilus	DQ286815	Ács et al. 2007	DQ286807	Ács et al. 2007	DQ286826	Ács et al. 2007
Plagiotrochus australis	-	-	AF395136	Rokas et al. 2002	AF395154	Rokas et al. 2002
Plagiotrochus quercusilicis	AF395178	Rokas et al. 2002	DQ218032	Stone et al. 2009	DQ201495	Stone et al. 2009
Plagiotrochus suberi	DQ286809	Ács et al. 2007	DQ218029	Stone et al. 2009	DQ201489	Stone et al. 2009
Striatoandricus nievesaldreyi ILV26	-	-	MK863038	This study	MK863245	This study
Striatoandricus nievesaldreyi ILV27	MK863042	This study	MK863039	This study	MK863246	This study
Striatoandricus georgei ILV28	-	-	MK863040	This study	MK863247	This study
Striatoandricus georgei ILV29	-	-	MK863041	This study	MK863248	This study
Trigonaspis mendesi	DQ012658	Ronquist et al. 2015	-	-	DQ012615	Ronquist et al. 2015

the hypopygium is slender without apical tuft, tarsal claws with a basal tooth and metasoma longitudinally carinated. If we do not consider the sculpture of the metasoma, *Striatoandricus* gen. nov. morphologically resembles *Andricus*, but in the genus *Andricus*, the metasoma is smooth, without sculpture.

In terms of metasomal sculpture, *Striatoandricus* gen. nov. mostly resembles *Kokkocynips* with striate and reticulate metasomal tergites. In *Striatoandricus* gen. nov., tarsal claws with distinct strong basal lobe, prominent part of ventral spine of the hypopygium 1.5–1.8 times longer than broad, head rounded in front view, nearly as broad as high, length of antennae nearly equal to length of the body, F2 and subsequent flagellomeres thin, long, F1 1.2–1.3 times longer than F2, lateral propodeal carinae curved outwards in the middle, central propodeal area smooth, shiny, lateral propodeal area coriaceous; 2nd metasomal tergite with large and dense patch of setae laterally, striated in the posterior half at least, all subsequent tergites reticulate, induce detachable multilocular or aggregate pubescent leaf galls. In *Kokkocynips*, tarsal claws are simple, without basal lobe, the prominent part of ventral spine of the hypopygium is 3.0–3.3 times longer than broad, head transverse in frontal view, broader than high, length of antennae nearly equal to length of head + mesosoma, F2 and subsequent flagellomeres are stout, shorter, F1 2.0 times longer than F2, lateral propodeal carinae toward distal part of propodeum gradually curved outwards, central and lateral propodeal areas dull rugose; all tergites uniformly reticulate, 2nd metasomal tergite with sparse lateral hairs, induce rounded detachable soft unilocular twig galls.

The galls are morphologically very similar to *Andricus* group *tecturnarum*, but in this case the adults have the metasoma completely smooth and shiny.

Description: Asexual female, body length 1.7–4.0 mm.

Color: Amber usually with black areas variably extended to black. Yellowish legs, last femur dark. Chestnut venation.

Head: Transversally ovoid, 1.2–1.5 as broad as high in frontal view, with gena slightly broadened behind the eye, alutaceous to coriaceous, with sparse white setae. Transfacial distance similar to the height of compound eye. Inner margins of compound eyes parallel. Lower face with irradiating striae from clypeus extending to the eye; malar sulcus absent. Fronts, vertex, and occiput strongly alutaceous to coriaceous, sometimes with some striae; occipital carina absent; postocciput and postgena alutaceous to smooth; posterior tentorial pits small; height of occipital and oral foramen similar to height of postgenal bridge; hypostomal carina emarginated (Fig. 1a); gular sulcus inconspicuous. Maxillary palps 5-segmented and labial palps 3-segmented (Fig. 1a). Antenna short, longer than head + mesosoma, with 11–13 flagellomeres, being F1 equal or longer than F2.

Mesosoma: Pronotum impressed along anterior margin, delicately coriaceous dorsally and laterally, almost smooth or with some transversal carinae (Fig. 1b–e); propleuron sculptured, alutaceous to coriaceous, with sparse setae. Mesoscutum coriaceous, usually without carinae or rugae; as long as broad or slightly longer than broad (greatest width measured across mesoscutum level with base of tegulae). Notauli present, complete or incomplete; parapsidal lines present sculptured; median mesoscutal line absent or not; anterior parallel lines distinct and sculptured; parascutal carina broad, extending to 2/3 of mesoscutum length. Mesoscutellum rounded, as broad as long or slightly longer, pubescent, alutaceous to coriaceous, rugose at least laterally, overhanging metanotum, not margined. Scutellar foveae transverse, separated. Mesopleuron alutaceous, with carinae or rugae. Dorsal axillar area alutaceous, with white setae; lateral axillar area alutaceous, with few setae; subaxillular bar smooth, glabrous, triangular, posteriorly as high as long; metapleural sulcus reaching mesopleuron at half of its height at least. Metascutellum coriaceous, rectangular, ventrally concave, glabrous ventral impressed area; metanotal trough smooth, pubescent or not; central propodeal area smooth and glabrous, without longitudinal central carina; lateral propodeal carinae curved; lateral propodeal area with dense setae without piliferous points. Nucha with longitudinal carinae.

Legs: All tarsal claws with strong basal lobe.

Forewing: longer than body, hyaline, pubescent, ciliated on margin, veins conspicuous, radial cell 3–4 times as long as broad, open; areolet triangular, closed and distinct; Rs + M not reaching basalis, its projection reaching basalis at half its length.

Metasoma: Slightly longer than mesosoma, slightly longer than high in lateral view. Length of 2nd metasomal tergite equal to half or 2/3 of metasoma's total length, with lateral setae, striated or partially striated and reticulated; subsequent tergites shorter, sculptured, striated and/or reticulated. Ventral spine of hypopygium needle-like, prominent part of ventral spine of hypopygium short, at most 4.0 times as long as broad from ventral view, with sparse setae, extending beyond apex of spine without forming a tuft.

Galls: Located in the lower part of the central vein of the leaf, in the upper part, or in the branches. It appears as a globose structure with long and dense pubescence without being brittle. They are yellowish, brown, sometimes purple or violet pink. The pubescence completely covers the larval chambers, which are fused

or individualized but together, in a variable number between 3 and 30; each individual gall is cylindrical, light brown in color, with a thick hard wall, from which the pubescence emerges. Host belongs to *Quercus* section.

Three species belong to this genus: *Striatoandricus nievesaldreyi* n. comb. and *S georgei* n. comb from México, and *S. maesi* n. comb. from Nicaragua. Two new species are also described here from México.

The species can be distinguished according to the following key:

1. Notauli incomplete, faint in anterior part of mesoscutum. Pronotum smooth or finely striated on lateral part (Fig. 1d–e) .. 2
- Notauli percurrent, distinctly marked along all the mesoscutum. Pronotum conspicuously striated (Fig. 1b–c) 3
2. Posterior medial sulcus present (Fig. 8d). F1 subequal in length to F2 (Fig. 8a); antenna with 13 flagellomeres (Fig. 8a). Striations in first metasomal tergite interrupted with some irregular smooth areas (Fig. 9a–b) ..... *S. sanchezi* n. sp.
- Medial sulcus absent (Fig. 3 c–d). F1 at least 1.2x F2 (Fig. 3e); antenna with 12 flagellomeres sometimes with a partial sulcus between F12 and F13 (Fig. 3f). Striations non-interrupted (Fig. 2c), sometimes with a small smooth dorsal area ..... *S. georgei*
3. Second metasomal tergite fundamentally areolated-reticulated (Fig. 2a), sometimes with striations very weak. Body color always dark 4
- Second metasomal tergite striated (Fig. 2b). Body color usually amber with or without black marks, rarely black 5
4. Body length (3.5–4.0 mm)*. Antenna with 12 flagellomeres. Front rugose (Fig. 2c). OOL and LOL shorter than diameter ocelli (Fig. 2c). Mesoscutum longer than wide with some linear elements (Fig. 2d). Big galls in twigs ..... *S. maesi*
- Body length (1.7–2.0 mm). Antenna with 11 flagellomeres (Fig. 4e). Front coriaceous (Fig. 4c). OOL and LOL longer than diameter ocelli (Fig. 4c). Mesoscutum as long as wide, uniformly coriaceous sculpture without linear elements (Fig. 5a). Small galls in leaves ..... *S. cuixarti* n. sp.
5. Second metasomal tergite completely sculptured, without smooth dorso-lateral area; with longitudinal striae strong. Mesoscutum longer than broad. Dorsal area of mesopleuron weakly sculptured to smooth. Forewing venation highly pigmented; Rs + M vein conspicuously connected to lower half of basal vein .. *S. barriosi*
- Second metasomal tergite usually with a dorso-lateral area smooth and shiny; longitudinal striae weak, slightly marked and incomplete, usually not reaching margin of metasomal tergite. Mesoscutum as long as broad. Mesopleuron entirely sculptured. Forewing with brown veins, not highly pigmented; Rs + M vein not connected to basal vein ..... *S. nievesaldreyi*

*In the original description the body length of *Andricus maesi* is wrong.

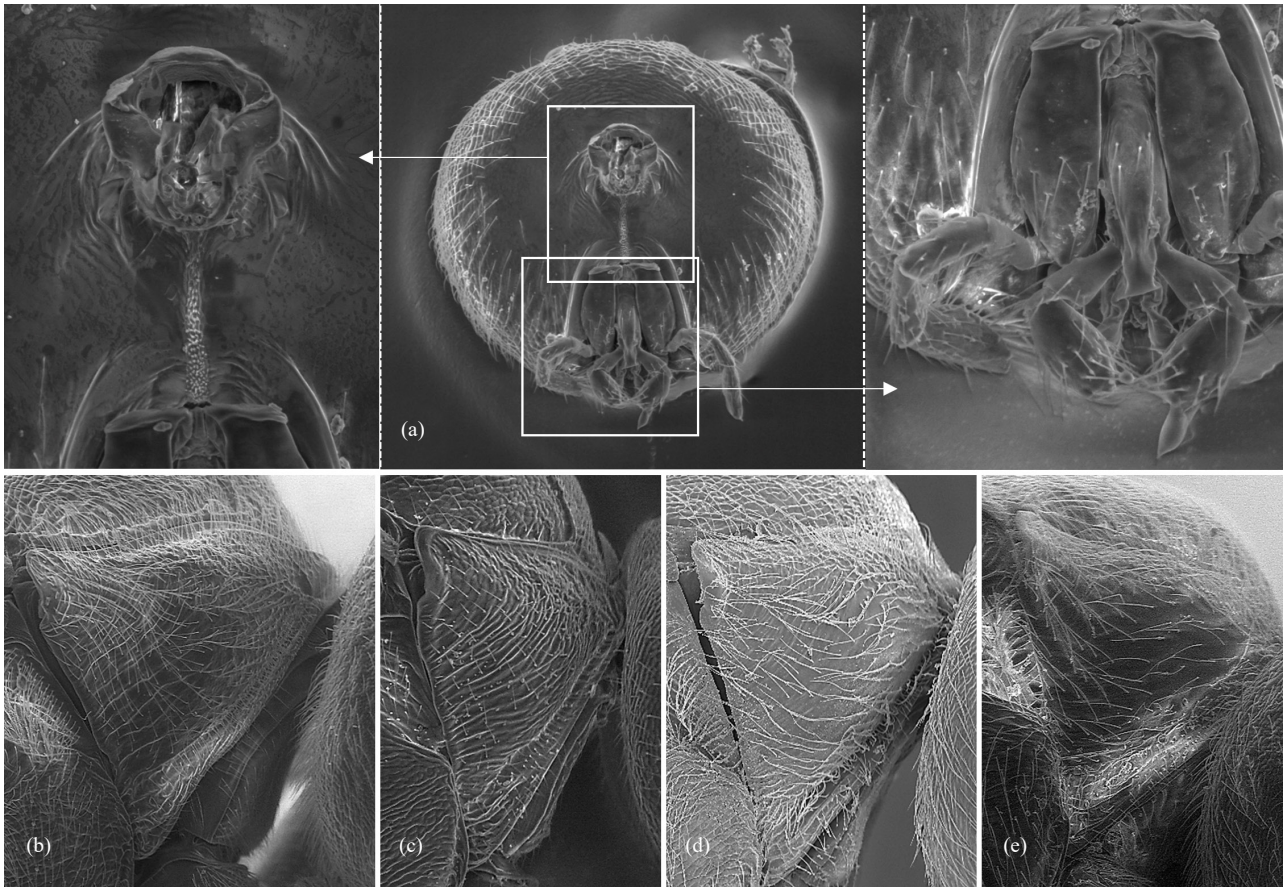

Fig. 1. (a) Head in posterior view of *S. georgei* with details of occipital foramen and gular area (left) and mouth parts (right). Pronotum in lateral view of: (b) *S. maesi*, (c) *S. cuxarti*, (d) *S. georgei* and (e) *S. sanchezi*.

***Striatoandrius barriosi* (Medianero and Nieves-Aldrey 2019) n. comb.**

Recently described species from Panama (Medianero and Nieves-Aldrey 2019). Morphologically, it has the second metasomal segment striated as *S. georgei*, *S. nievesaldreyi* and *S. sanchezi* n. sp. and the notauli are percurrent as *S. nievesaldreyi*.

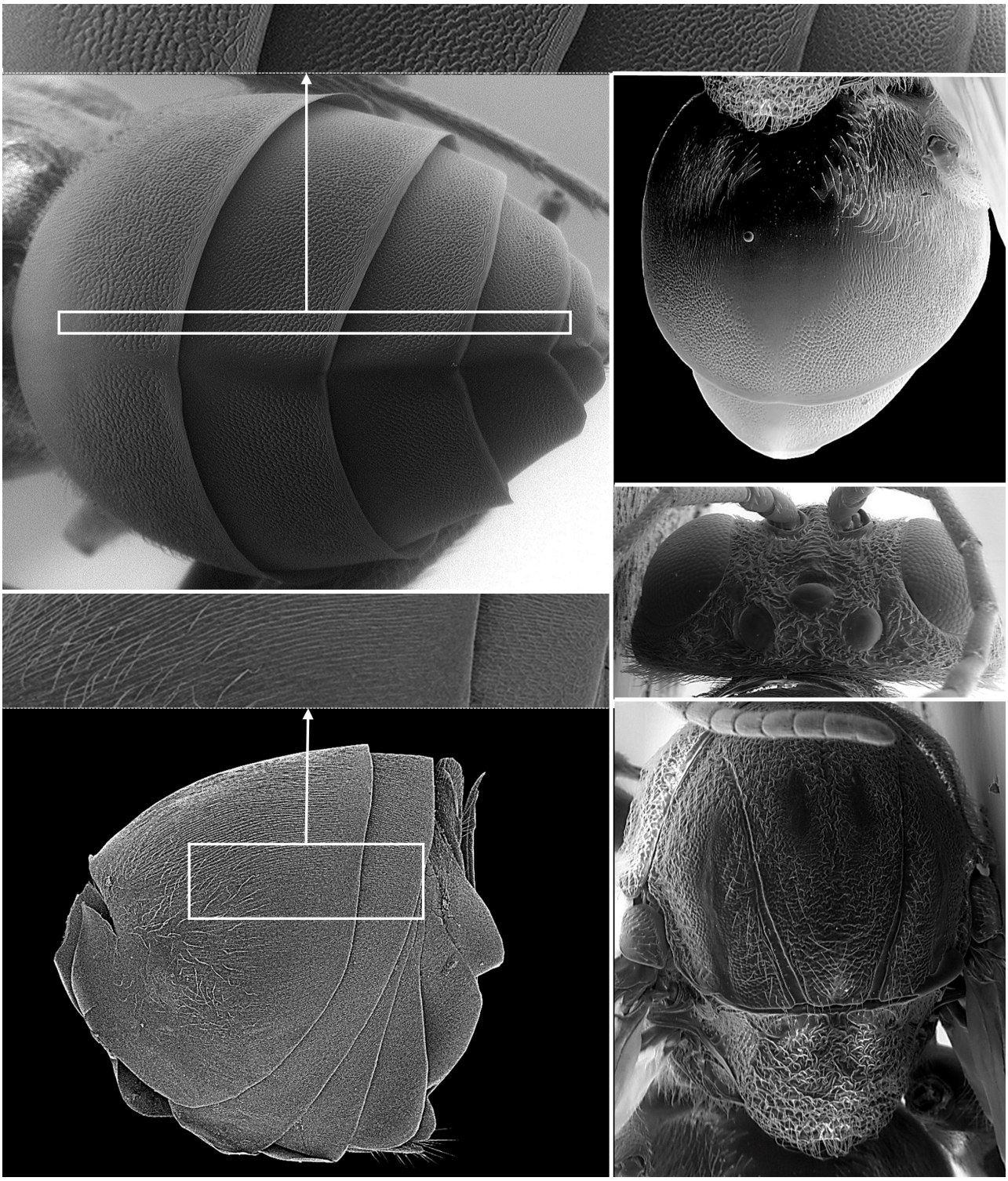

Fig. 2. Metasomal sculpture of *S. maesi* (a–b) and *S. georgei* (c). *Striatoandricus maesi*: (d) head in dorsal view, (e) mesosoma in dorsal view.

Striatoandricus barriosi differs from *S. nievesaldreyi* in that its second mesosomal tergite completely sculptured, without smooth dorso-lateral area with longitudinal striae strong, well-marked and visible, almost reaching posterior margin of metasomal tergite (usually with a dorso-lateral area smooth and shiny with striae weak, slightly marked and incomplete, not reaching margin of metasomal tergite in *S. nievesaldreyi*), mesoscutum longer than broad (as long as broad in *S. nievesaldreyi*), dorsal area of mesopleuron weakly sculptured to smooth (entirely sculptured in *S. nievesaldreyi*), forewing venation strongly pigmented (brown veins

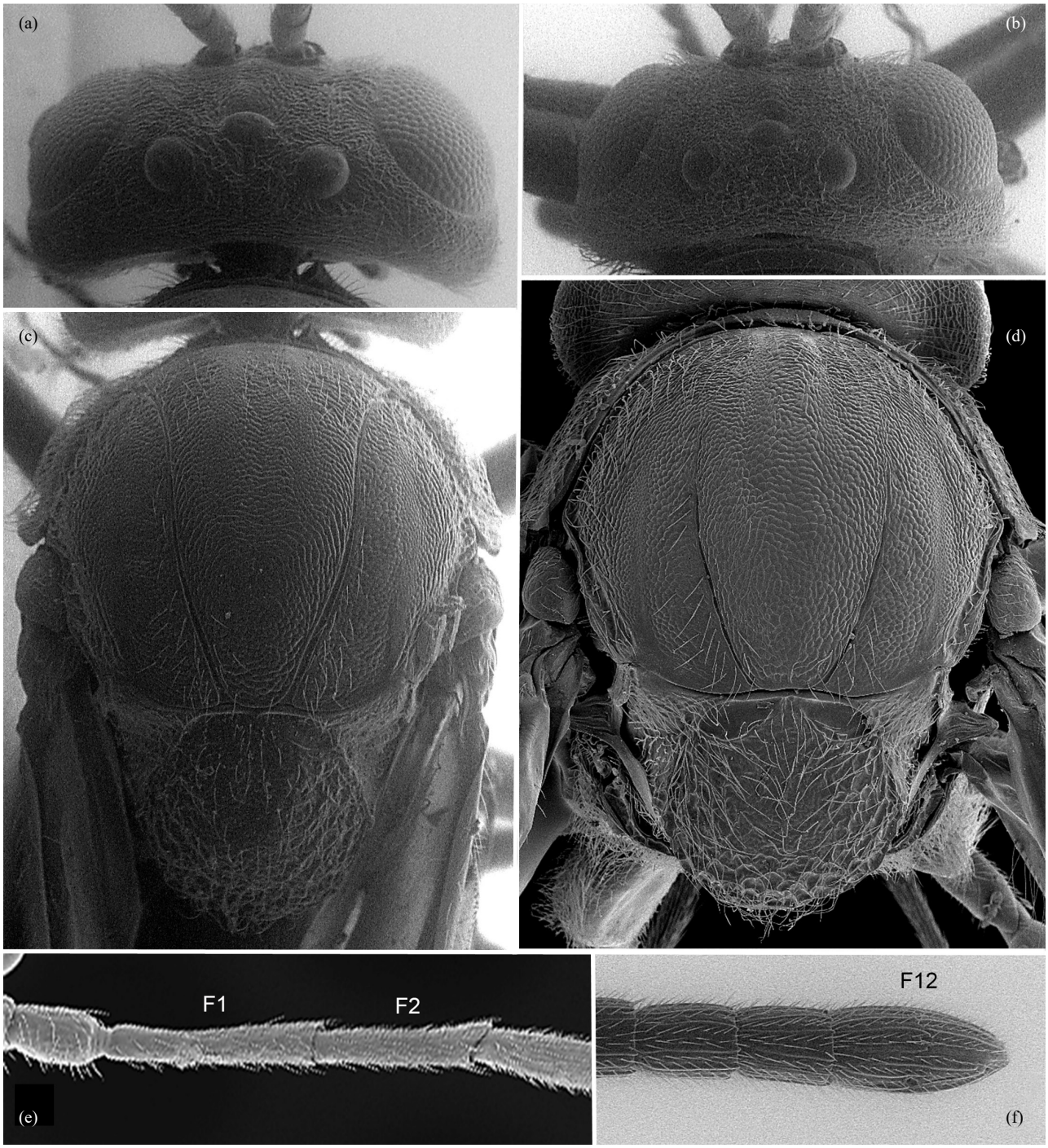

Fig. 3. Head in dorsal view: (a) *S. nievesaldreyi* and (b) *S. georgei*. Mesosoma in dorsal view: (c) *S. nievesaldreyi* and (d) *S. georgei*. First flagellomeres (e) and last flagellomeres (f) of *A. georgei*.

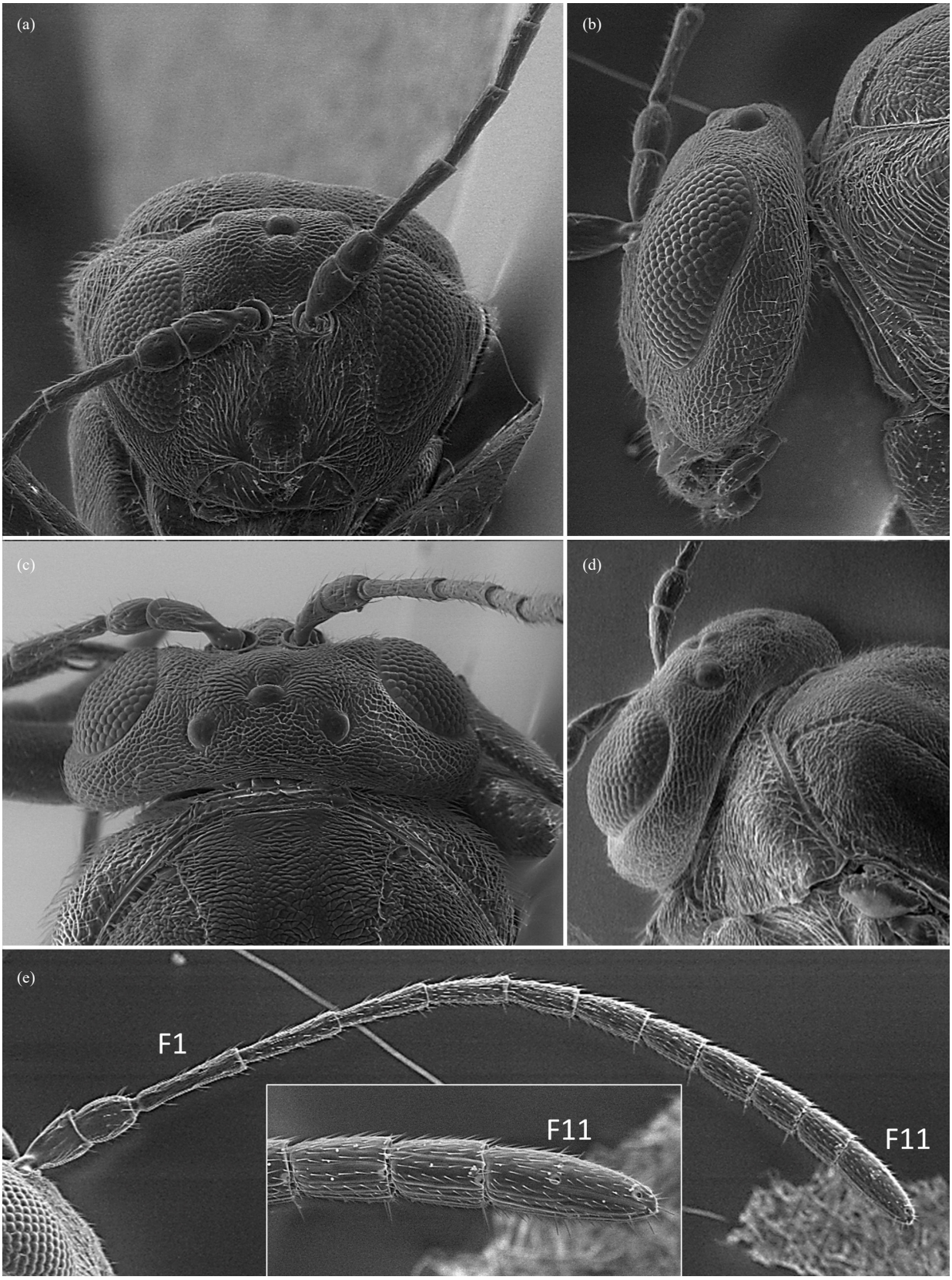

Fig. 4. *Striatoandricus cuixarti* n. sp.: (a) head in frontal view, (b) head in lateral view, (c) head in frontal view, (d) head and mesosoma in dorso-lateral view, (e) antenna with details on last flagellomeres.

in *S. nievesaldreyi*) and Rs + M vein conspicuously connected to lower half of basal vein (Rs + M vein not connected to basal vein in *S. nievesaldreyi*).

The gall is a fused mass of larval chambers as also occurs in *S. georgei*, *S. nievesaldreyi* and *S. sanchezi* n. sp. Galls of *S. barriosi* occurs in *Q. bumelioides* Liebm. and *Q. insignis* M. Martens and Galeotti (section *Quercus*).

Remarks: In Medianero and Nieves-Aldrey (2019) mention that this species can also be differentiated from *S. nievesaldreyi* by its color (black in *S. barriosi* and ambarine in *S. nievesaldreyi*). Nevertheless, after studying long series of *S. nievesaldreyi*, the coloration is very variable in this species including specimens completely ambarine, specimens ambarine with variable black marks or specimens completely black.

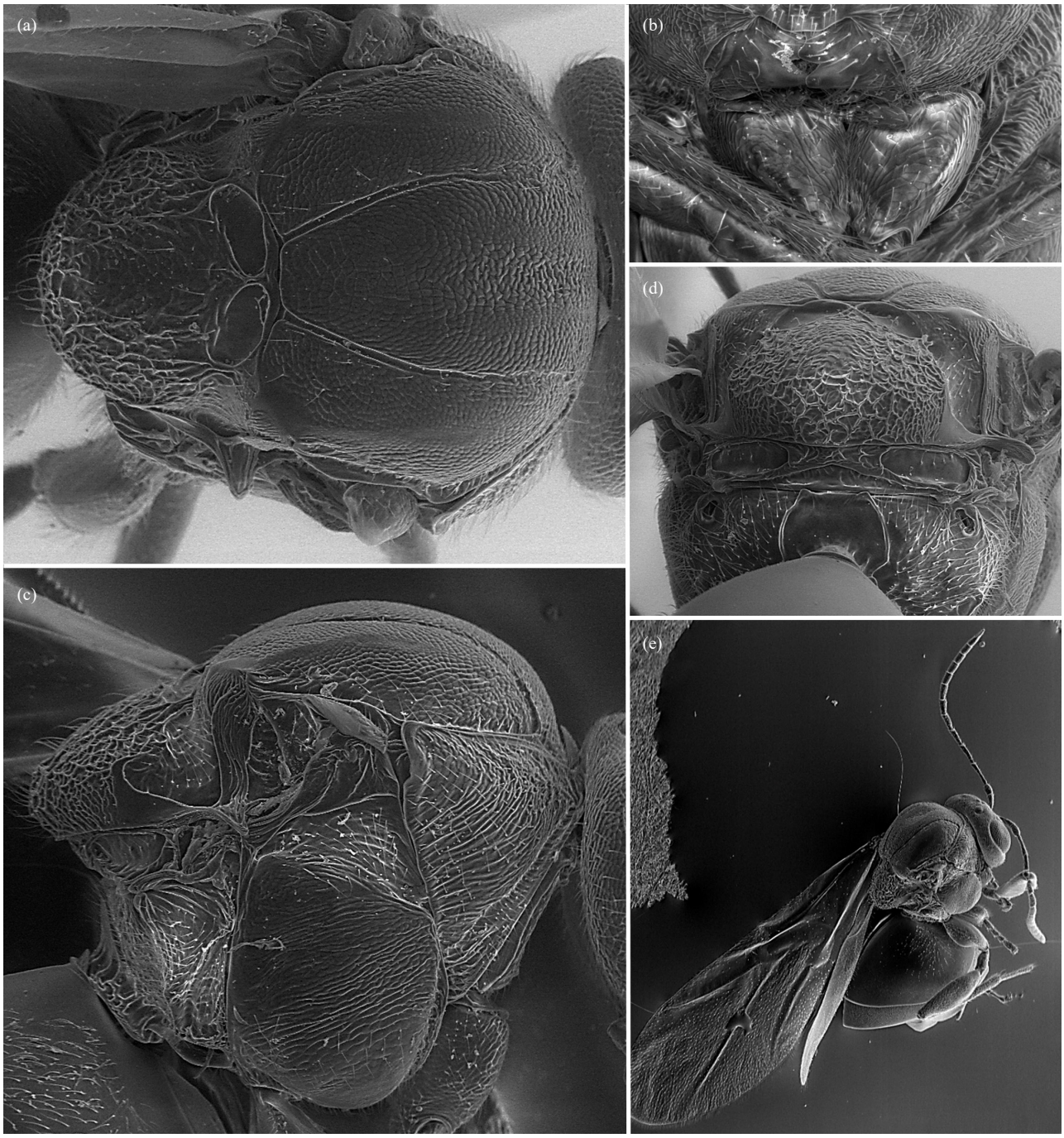

Fig. 5. *Striatoandricus cuixarti* n. sp.: (a) mesosoma in dorsal view, (b) propleurae, (c) mesosoma in lateral view, (d) propodeum, (e) body.

Also, the authors of the same paper mention that the gall of *S. barriosi* is similar to that of *Andricus guatemalensis* (Cameron 1883); this species has been considered *incertae sedis* by Pujade-Villar et al. (2011) because is not possible to differentiate the species according to the morphology of galls. In the original description, Cameron (1883: 71) mentions that the gall of *Cynips guatemalensis* is a hard mass covered of a long pilosity, but the adults obtained corresponds to an inquiline *Synergus dorsalis* Cameron (see the dissertation in Ritchie and Shorthouse 1987).

Striatoandricus cuixarti **Pujade-Villar n. sp.**

(Figs. 4–7)

urn:lsid:zoobank.org:act:51C9A3E3-4C63-439C-8C63-2CC06C36DB7E

Type material: HOLOTYPE ♀ deposited in JP-V col. (UB) with the following labels: "MEX-209, Tunal-salto (municipio de San Felipe del Progreso, Estado de México), -99°96'21"N, 19°71'37"W, 2650 m.s.n.m." (white label); "Ex. *Q. frutex*, (26.xii.2013) 26.ii.2014, R. Delia García-Martiñón leg.," (white label); Holotype *Striatoandricus cuixarti* Pujade-Villar n. sp. Desig-2019" (red label). PARATYPES (26 ♀): 9 ♀ with the same labels as holotype (UB); same labels 5.iii.2014: 2 ♀ (CP), 12.iii.2014: 1 ♀ (UB), 20.iii.2014: 4 ♀ (2 ♀ UB; 2 ♀ USNM); (28.ix.2013) 28.i.2014: 6 ♀ (UB), 30.iv.2014: 4 ♀ (2 ♀ UB; 2 ♀ AMNH).

Additional material: Agua Blanca de Iturbide (Hidalgo), *Q. frutex*, (7.xi–2013) ii–2014: 2 ♀ (leg. D. Cibrian-Tobar, col. UMBR).

Etymology: Species dedicated to Jordi Cuixart i Navarro, pacifist and Catalan activist, president of Òmnium Cultural, who is in preventive prison in Spain.

Diagnosis: The new species is the only species of the genus with adults provided with 11 segments in the antennal flagellomeres and the only species with small rose to blue galls.

Description: (agamic generation),

Length: 1.7–2.0 mm (n = 7).

Color (Fig. 7a): Chestnut; proximal half of antennae and distal half of legs amber; head and lateral if mesosoma dark chestnut/brown, black mesosoma dorsally; metasoma a slightly lighter; wing venation light brown.

Head (Fig. 4a–d): With sparse setae, not dense. Coriaceous with fine carinae extending from lateral margins of clypeus to basal and lower lateral margins of compound eyes; medial area of face elevated between toruli and clypeus, coriaceous, not carinated; front and vertex coriaceous. Transversally ovate in frontal vision, 1.2x wider than high; 2.6x wider that high in dorsal view, narrower than the mesosoma width. Gena coriaceous, maximum width subequal to maximum width of compound eye. Malar space 0.3x as long as height of compound eye, malar sulci absent. POL:OOL:LOL distances 5:2:2; maximum diameter of lateral ocellus 1.4. Transfacial line slightly longer than maximum height of compound eye. Toruli diameter greater than space between them (2.5:1), but slightly shorter than distance to compound eye (2.5:3). Clypeus trapezoidal, mostly coriaceous and smooth on the ventral margin; sparsely pubescent on ventral half; tentorial pits present; epistomal sulci and clypeo-pleurostomal line inconspicuous; anterior margin slightly prominent not medially incised. Front slightly elevated in central part not forming a median carina.

Antennae (Fig. 4e): With 13 segments, shorter than total length of body (34:53), but longer than head + mesosoma (34:30); pedicel slightly longer than broad; placoid sensilla present from distal half of F3 onwards. F4–F13 broader than F1–F3; F1 similar in length to F2. Antennal formula: 30: 22: 43: 40: 35: 31: 27: 27: 24: 24: 21: 21: 38.

Mesosoma (Figs. 1c, 5): Slightly longer than high in lateral view, with setae in pronotum, mesepimeron, scutellum, propodeum and along notauli. Pronotum mostly striated with some alutaceous areas; anterior margin narrow and emarginated. Mesoscutum coriaceous, as broad as long (measured at tegulae level); notauli complete; medial line absent; anterior parallel and parapsidal lines visible through a finer sculpture. Scutellum mostly coarsely rugulose with dorsal coriaceous and glabrous central area; almost as long as broad, 0.5x longer than mesoscutum; protruding posteriorly over metanotum; scutellar fovea smooth, ellipsoid, separated by a septum, broader than long, and slightly oblique to transversal axis; axillae smooth to finely alutaceous with sparsely pubescence. Mesopleura with some striae, speculum mostly alutaceous to coriaceous; mesepimeron striate with uniform pubescence; mesepisternum glabrous on superior half and sparsely pubescent with fine sculpture on lower half. Dorsellum subrectangular, convex inferiorly, uniformly rugulose; metanotal trough smooth and glabrous. Metapleura uniformly pubescent; metapleural sulcus reaching mesopleuron in the half of its height. Propodeum carinae curved to the lateral sides; central part smooth and glabrous; lateral area uniformly pubescent and finely alutaceous. Nucha present, with longitudinal carinae; posteriorly margined.

Wings (Fig. 7a): Forewings 1.5x longer than body, hyaline, margins ciliate; radial cell around 4x longer than broad; R1 not reaching anterior margin of forewing; Rs not projected; areola closed forming a triangle; Rs + M projection reaching in the lower half of basal vein.

Legs: Tarsal claws with a conspicuous tooth forming an acute angle (Fig. 6e).

Metasoma (Fig. 6a–d): Slightly longer than high and 1.2x longer than mesosoma in lateral view; second metasomal tergite covering more than half of metasoma, smooth and pubescent on anterior half, lateral pubescence not reaching margins of tergite, reticulate and glabrous on posterior half with smooth posterior

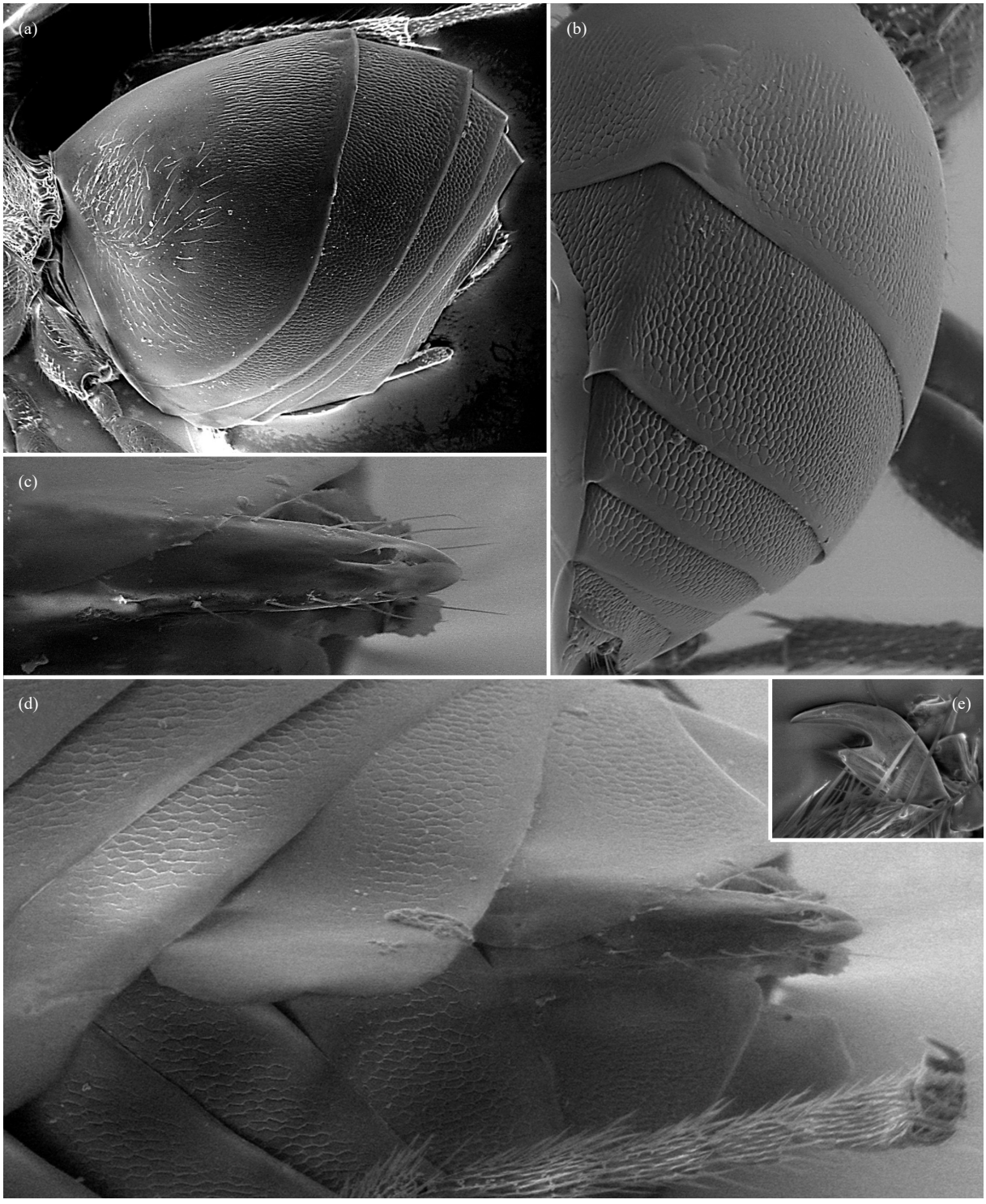

Fig. 6. *Striatoandricus cuixarti* n. sp.: (a) metasoma in lateral view, (b) metasoma in dorsal view, (c) ventral spine of hypopygium, (d) metasoma in ventral view, (e) tarsal claw.

margin; rest of tergites with strongly sculpture similar to posterior half of second tergite, coriaceous to reticulated with the distal margin smooth and shiny; ventral spine of hypopygium around 4x longer than broad, incise distally and with 5 lateral setae on each side that project over the tip of the spine, not forming a tuft.

Gall (Fig. 7b–e): Located in the lower part of the central nerve of the leaf. It appears as a pubescent circular ball of small size (6–9 mm long by 5–6 mm wide), cream-colored sometimes purple. The 2mm thick pubescence is not brittle and completely covers the larval chambers. The larval cameras are together, not fused, which are cylindrical, light brown; its size is about 3mm long by 1mm wide. The number of larval cameras ranges from 2 to 6.

Biology: Only asexual females are known. The galls appear in July and the adults emerge in March or April of the following year.

Host: It occurs on *Q. frutex* Trel. (section *Quercus*).

Distribution: México (Hidalgo and Estado de México).

Stiatoandricus georgei (Pujade-Villar 2011) n. comb.

Andricus georgei Pujade-Villar 2011; in Pujade-Villar et al. 2011: 28–31.

Studied material: For type material consult Pujade-Villar et al. (2011) (see host comments below). Additional material: MEX-047, Parque Nacional de la Sierra de Quila (Tecolotlán. Jalisco, México), (06. iii.2010) 16–20.iii.2010: 3♀, Ex *Q. magnoliifolia*, A. Equihua and E. Estrada leg.; MEX-050, Parque Macional de la Sierra de Quila (Tecolotlán. Jalisco, México), (06.iii.2010) 16–20.iii.2010: 2♀, Ex *Q. magnoliifolia*, A. Equihua and E. Estrada leg.; MEX-065, Arroyo Hondo (Monte Escobedo, Zacatecas, México), (06.iii.2010) 16–20.iii.2010: 4♀, *Q. resinosa*, leg. A. Equihua and E. Estrada leg.; MEX-097, Parque Nacional Bosque del Pedregal (Ciudad de México, México), (21.xii.2012) 15.ii.2013: 6♀ Ex *Q. deserticola*, Miriam Serrano leg.; MEX-125, Path behind Oceania, Parque de conservación de la vida silvestre Africam Safari (Tecali de Herrera, Puebla, México), (11.xii.2011) 05.ii.2012: 5♀, Ex *Q. laeta*, Armando Equihua-Martínez leg.; MEX-138, La Mojonera, Parque de conservación de la vida silvestre Africam Safari (Tecali de Herrera, Puebla, México) (21.xii.2012) ii.2013: 2♀, Ex *Q. glaucoides*, Lilia Ramírez leg.; MEX-196, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (18.i.2014) 16.ii.2014: 1♀, Ex *Q. deserticola*, R. Delia García-Martiñón leg. (N43); MEX-197, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (23.i.2014) 16.ii.2014: 3♀, Ex *Q.* x *deserticola*, R. Delia García-Martiñón leg. (N33a); MEX-198, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (30.i.2014) 15.ii.2014: 3♀, Ex *Q. deserticola*, R. Delia García-Martiñón leg. (N49); MEX-201, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (19.xii.2013) 23.i.2014: 3♀, Ex *Q. obtusata*, R. Delia García-Martiñón leg. (N18); MEX-206, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (18.i.2014) 05.ii.2014: 9♀, Ex *Q. deserticola*, R. Delia García-Martiñón leg. (N47); MEX-210, Plateros-Arenales (San Felipe del Progresso, Estado

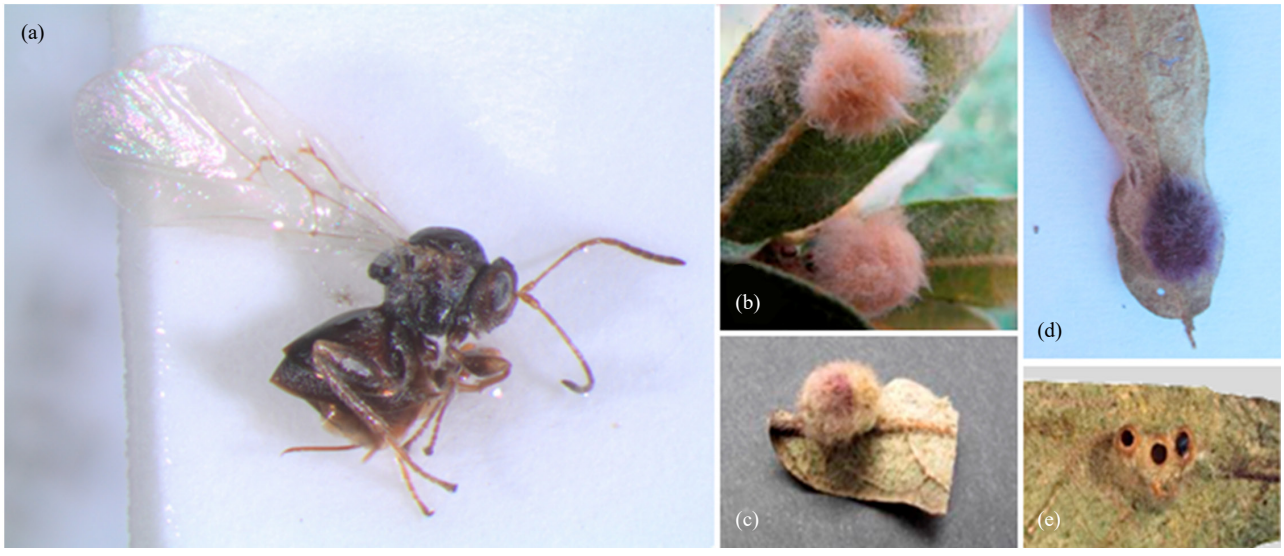

Fig. 7. *Striatoandricus cuixarti* n. sp.: (a) body, (b–d) galls, (e) larval chambers.

de México, México), (19.xii.2013) 16.ii.2014: 5♀, Ex *Q. obtusata*, R. Delia García-Martiñón leg. (N22); MEX-213, Plateros-Arenales (San Felipe del Progresso, Estado de México, México), (29.xii.2013) 18.ii.2014: 5♀, Ex *Q. deserticola*, R. Delia García-Martiñón leg. (N27); MEX-318, Mineral el Chico: Mineral el Chico (Hidalgo, México), (08.x.2014) 20-x.2014: 1♀, Ex *Q. rugosa*, Elgar Castillo leg. (11G); MEX-324, 324, Huitzilac: Huitzilac (Morelos, México), (06.xii.2016) 18-xii.2016: 1♀, Ex *Q. glabrescens* × *obtusata*, Elgar Castillo leg. (2A); MEX-327, Coajomulco (Morelos, México), (05.xii.2014) 17-xii.2014: 3♀, Ex *Q. rugosa*, Elgar Castillo leg. (12H); MEX-328, Coajomulco (Morelos, México), (05.xii.2016) 12-xii.2016: 1♀, Ex *Q. rugosa*, Elgar Castillo leg. (12I); MEX-347, Santa Fe (Ciudad de México, México), (25.iii.2016) iii.2016: 1♀, Ex *Q. laeta*, DCT leg. (2881); MEX-348, Santa Fe (Morelos, México), (15.i.2016) ii.2016: 1♀, Ex *Q. laeta*, DCT leg. (2882); MEX-349, Santa Fe (Ciudad de México, México), 16.iii.2016 (iii.2016): 26♀, Ex *Q. laeta,* DCT leg. (2863) MEX-151, Santa Fe (Ciudad de México, México), (26.iii.2013) 28.iii-12.iv.2013: 26♀, Ex *Q. laeta,* DCT leg.

Hosts: In *Quercus*, section *Quercus*: *Q. deserticola* Trel., *Q. glabrescens* × *obtusata*, *Q. glaucoides* M. Martens and Galeotti, *Q. laeta* Liebm., *Q. magnoliifolia* Née, *Q. resinosa* Née and *Q. rugosa* Née (*Quercus* section); after a reexamen of host by S. Valencia-A, the host mentioned in Pujade-Villar et al. (2011, *Q. mexicana* Humb. and Bonpl.) is wrong, the correct host is *Q. deserticola* Trel. All host are new records from this species.

Distribution: México, described from material collected in the Parque Nacional del Bosque del Pedregal (Bosque de Tlalpan, Ciudad de México). Its distribution is extended to have collected it in the states of Hidalgo, Jalisco, Michioacan, Morelos, Puebla and Zacatecas.

Remarks: Adults of this species have high morphological variability in the following characters: (i) the color is very variable, usually is ambarine with black marks but some specimens lacks black marks and others are almost black; (ii) OOL is usually shorter than diameter of posterior ocelli, but in some specimens OOL is larger; (iii) the length of notauli are usually short reaching the tegulae level but in some specimens are longer reaching until 3/4 of mesoscutum length; (vi) the metasoma sculpture is usually striated in second metasomal tergite but is some specimens exist also a reticulate sculpture more or less extended from margin of this tergite towards the basal area; (v) usually the second metasomal tergite is completely sculptured but in some specimens there is smooth in dorsal small area. The authors suggest that this variability may be indicative of a group of species. Further research should asses this matter.

Striatoandricus maesi (Pujade-Villar 2015) n. comb.

Andricus maesi Pujade-Villar 2015: 40–42

Studied material: For type material consult Pujade-Villar (2015). México: UNSIJ, Ixtlán de Juárez (Oaxaca), ex *Q. glaucoides*, (15.i.2010) 15.ii.2010: 13♀ (leg. R. Clark); same location, *Q. obtusata*, (15.i.2010) 15.ii.2010: 14♀.

Hosts: *Q. segoviensis* Liebm., *Q. glaucoides* Mart. and Gal. and *Q. obtusata* Humb. and Bonpl. (section *Quercus*); also probably in *Q. potosina* Trel., *Q. microphylla* Née and *Quercus* nr *rugosa* (section *Quercus*, see remarks).

Distribution: Nicaragua, described from material collected in the cerro de Tisey (Estelí, Reserva Natural Tisey Estanzuela); México (Oaxaca) in this paper and probably also in the following states (see below): Jalisco, Michoacán, Puebla and Zacatecas. First record from México.

Remarks: Similar galls without any emergence were collected in Zacatecas (México): Mesa de San Gabriel (*Q. potosina* Trel.) and La Cumbre (*Q. microphylla* Née); also in Puebla (México): Camotepec (*Q. obtusata*); in Michoacán (México): Urapan (*Quercus* sp); and in Jalisco (México): Las Guayabas (*Quercus* nr *rugosa*).

Stiatoandricus nievesaldreyi (Pujade-Villar 2011) n. comb.

Andricus mexicanus Kinsey 1920: 309 [non *Andricus mexicana* Bassett, 1890]

Andricus nievesaldreyi Pujade-Villar 2011; in Pujade-Villar et al. 2011: 32 [new name]

Studied material: For type material consult Kinsey (1920) and Pujade-Villar et al. (2011).

Additional material: MEX-039, Parque Nacional de la Sierra de Quila (Tecolotlán, Jalisco, México), (06.iii.2010) 16–20.iii.2010: 6♀, Ex *Q. magnoliifolia*, A. Equihua and E. Estrada leg.; MEX-050, Parque Nacional de la Sierra de Quila (Tecolotlán. Jalisco, México), (06.iii.10) 16–20.iii.10: 2♀, Ex *Q. magnoliifolia*, A. Equihua and E. Estrada leg.; MEX-308, Natívitas (Tlaxcala, México), (13.i.2015) 19.ii.2015: 2♀, Ex *Quercus* sp., A. Equihua and E. Estrada leg.; MEX-318, Mineral el Chico: Mineral el Chico (Hidalgo, México), (08.x.2014) 20-x.2014: 1♀, Ex *Q. rugosa*, Elgar Castillo leg. (11G); MEX-319, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 22-

xii.2016: 11♀, Ex *Q. rugosa*, Elgar Castillo leg. (11H); MEX-322, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 16-xii.2016: 9♀, Ex *Q. rugosa*, Elgar Castillo leg. (12C); MEX-323, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 16–xii.2016: 4♀, Ex *Q. rugosa*, Elgar Castillo leg. (12D); MEX-325, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 11-xii.2016: 2♀, Ex *Q. rugosa*, Elgar Castillo leg. (12F); MEX-329, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 15-xii.2016: 1♀, Ex *Q. rugosa*, Elgar Castillo leg. (12J); MEX-345, Zumpimito (19°22'27.4"N, 102°02'56.7"W), Urapan (Michoacán, México), (iii.2018) 15.vi.2018: 6♀, Ex *Quercus* sp, A. Equihua and E. Estrada leg.; MEX-346, Coajomulco: Coajomulco (Morelos, México), (05.xii.2016) 17.xii.2016: 5♀, Ex *Q. rugosa*, Elgar Castillo leg.(12G); MEX-347, Santa Fe (Ciudad de México, México), 15.i.2016 (25.iii.2016): 6♀, Ex *Q. laeta*, DCT leg. (2881). Supplementary material: MEX-105 MAZ-Unknown location (México), (10.i.2012) 07.ii.2012, Ex *Quercus* sp., A. Equihua and E. Estrada leg.

Hosts: The first hosts for this species are mentioned here: *Q. laeta* Liebm., *Q. magnoliifolia* Née and *Q. rugosa* Née (*Quercus* section).

Distribution: México, described from material collected in the Sierra de Nayarit (Jalisco, México). Its distribution also includes in the states of Ciudad México, Hidalgo, Michoacán, Morelos and Tlaxcala.

Remarks: Kinsey (1920) described *Andricus mexicanus* from four adults that emerged in 1919 from galls on the upper side of leaves. Those galls were collected in 1900 by Diquet in Sierra de Nayarit (Jalisco, México) presumably from *Q. magnifolia* Née (= *Q. macrophylla* Née). Kinsey (1920) assigned to this species the individuals determined as *Andricus mexicana* Bassett, 1890 and *Cynips guatemalensis* Cameron, 1883 from the collections of Bassett (1890) at Guadalajara mountains (México) and Cameron (1883) at San Jerónimo (Guadalajara, México), respectively. A solution for the homonymy between Kinsey's and Bassett's species was proposed in Pujade-Villar et al. (2011) by changing the name of *Andricus mexicanus* Kinsey 1920 to *Andricus nievesaldreyi* Pujade-Villar 2011. The species *A. mexicana* Bassett and *C. guatemalensis* Cameron were only described through velvety galls on leaves. Both adults with smooth metasoma (*Andricus tecturnarum* group) and with striate metasoma (*Striatoandricus*) emerge from this type of galls from USA and México. Thus, Pujade-Villar et al. (2011) considered those two species *incertae sedis* until similar galls are collected at the type localities and the adults emerge.

There exists a big morphological variability in adults of this species in the following characters: (i) the color is very variable, usually is ambarine with black marks but some specimens lack black marks and others are black and (ii) the metasoma sculpture has smooth areas with variably extension.

Striatoandricus sanchezi **Pujade-Villar n. sp.**

(Figs. 8–10)

urn:lsid:zoobank.org:act:8DD9822F-1911-4213-BF47-0E43BD4E9032

Type material: HOLOTYPE ♀ deposited in JP–V col. (UB) with the following labels: "Parque Nacional de Sierra de Quila (Tcolotlàn, Jalisco, México), 20°16'40.98"N, 104°05'06.22"W (white label), "Ex *Quercus magnoliifolia* Née, (06–iii–10) 16/20–iii–10, A. Equihua and E. Estrada leg." (white label); "Holotype *Striatoandricus sanchezi* Pujade-Villar n. sp. desig–2019" (red label). PARATYPES: 4♀ with the same labels of Holotype (deposited in JP-V col. (UB)).

Etymology: Species dedicated to Jordi Sànchez i Picanyol, pacifist and Catalan activist, president of the Assemblea Nacional de Catalunya (ANC) when he entered into a preventive prison in Spain.

Diagnosis: The new species is the only species of the genus with posterior median sulcus and 15 antennomers segments.

Description: (agamic generation)

Length: 2.1–3.0 mm (n = 5).

Color (Fig. 10a): Chestnut; proximal half of antennae and distal half of legs amber; head and mesosoma chestnut with some black marks; metasoma slightly lighter; wing venation light brown.

Head (Fig. 8b–c): With sparse setae, not dense. Coriaceous with fine carinae extending from lateral margins of clypeus to basal and lower lateral margins of compound eyes; medial area of face elevated between toruli and clypeus, finely alutaceous, not carinated; front and vertex coriaceous. Transversally ovate in frontal vision, 1.1x wider than high; 2.1x wider that high in dorsal view, narrower than the mesosoma width. Gena coriaceous, maximum width subequal to maximum width of compound eye. Malar space 0.3x as long as height of compound eye, malar sulci absent. POL:OOL:LOL distances 32:12:15; maximum diameter of lateral ocellus 12. Transfacial line slightly longer than maximum height of compound eye. Toruli diameter 2.0x longer than space between them, and subequal to distance to compound eye. Clypeus trapezoidal, mostly smooth; sparsely pubescent; tentorial pits present; epistomal sulci and clypeo-pleurostomal line inconspicuous; anterior margin slightly prominent not medially incised. Front slightly elevated in central part not forming a median carina.

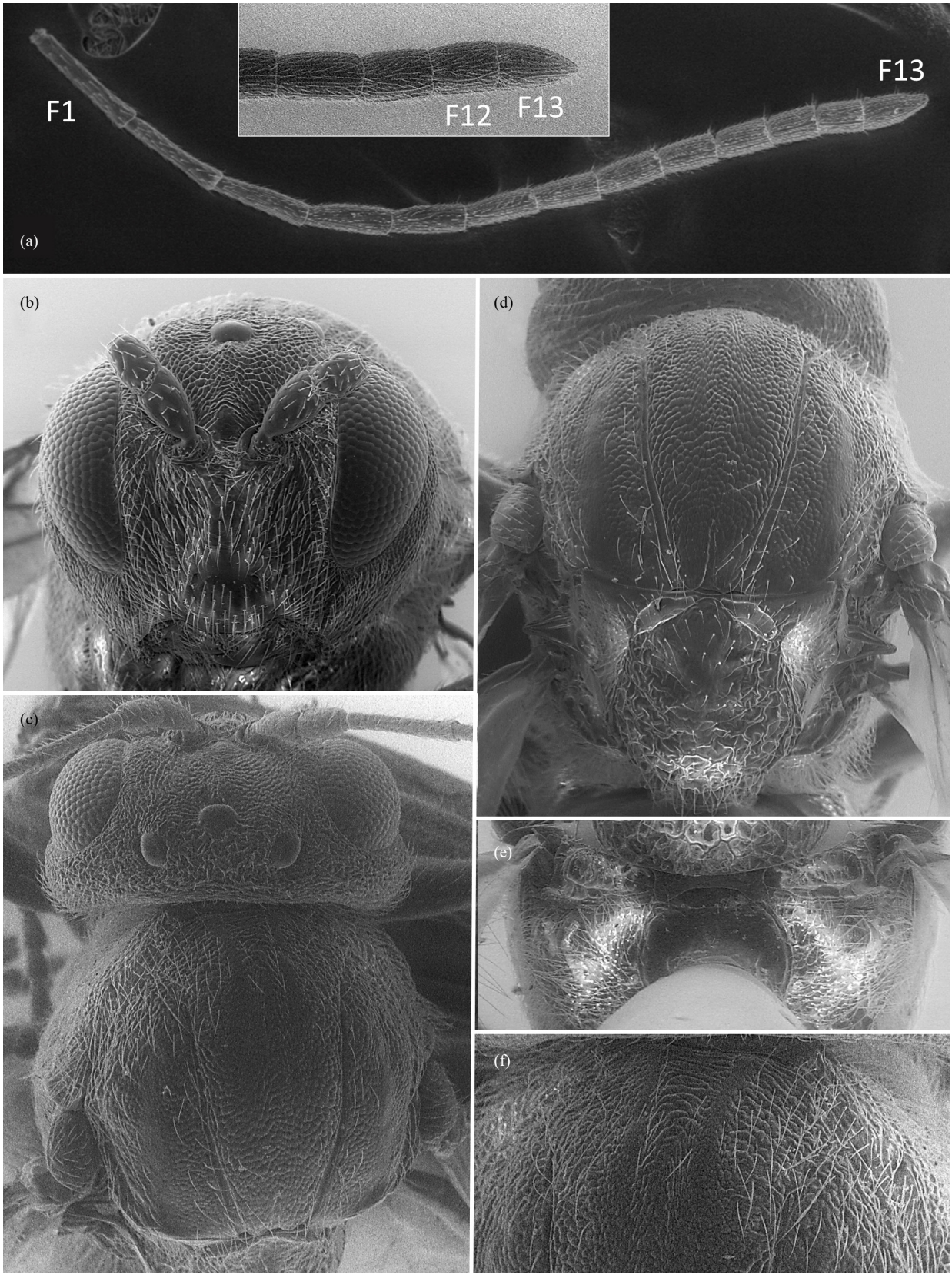

Fig. 8. *Striatiandricus sanchezi* n. sp.: (a) antenna with detail of last flagellomeres, (b) head in frontal view, (c) head and mesosoma in dorsal view, (d) mesosoma in dorsal view, arrow indicates median sulcus, (e) propodeum (f) detail of anterior part of mesosoma.

Antennae (Fig. 8a): With 15 segments, shorter than total length of body (7.3:8.5), but longer than head + mesosoma (7.3: 4.5); pedicel slightly longer than broad; placoid sensilla present from distal half of F3 onwards. F4–F13 broader than F1–F3; F1 similar in length to F2. Antennal formula: 14: 10: 24: 21: 19: 17: 16: 14: 14: 11: 11: 10: 9: 14.

Mesosoma (Figs. 1e, 8d–f, 9b–c): Slightly longer than high in lateral view, with setae in pronotum, mesepimeron, scutellum, propodeum and along notauli. Pronotum almost smooth with some alutaceous areas; anterior margin narrow and emarginated. Mesoscutum coriaceous, slightly broader than long (measured at tegulae level); notauli incomplete but long, extending about 0.8x of total length of mesoscutum; medial line present, 0.25x as long as mesoscutum; anterior parallel and parapsidal lines visible through a finer sculpture. Scutellum circular, lateral and posterior thirds coarsely rugulose with dorsal coriaceous, almost smooth, and glabrous central area; almost as long as broad, 0.6x longer than mesoscutum; protruding posteriorly over metanotum; scutellar fovea smooth, ellipsoid, separated by a septum, broader than long, and slightly oblique to transversal axis; axillae smooth to finely alutaceous

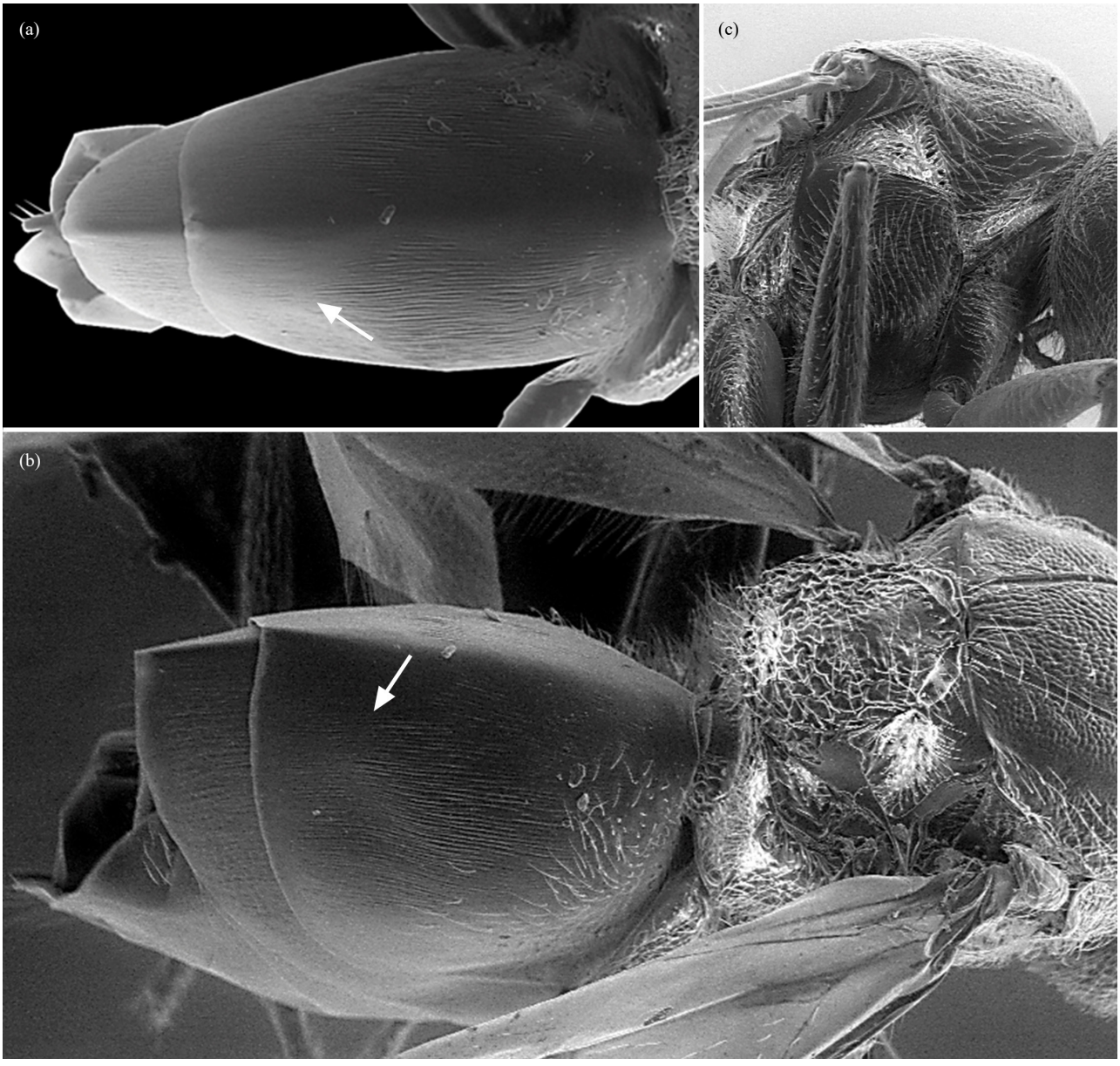

Fig. 9. *Striatiandricus sanchezi* n. sp.: (a) metasoma in dorsal view, (b) distal part of mesosoma and metasoma in dorso-lateral view, (c) mesosoma in lateral view. Arrows indicate irregular smooth areas.

with sparse pubescence. Mesopleuron striated, speculum alutaceous with some piliferous points; mesepimeron striate with uniform dense pubescence; mesepisternum glabrous on superior third and sparsely pubescent with fine sculpture on lower half. Dorsellum subrectangular, convex inferiorly, smooth on central part and laterally rugulose; metanotal trough rugulose. Metapleura uniformly pubescent; metapleural sulcus reaching mesopleuron in the upper 2/3 of its height. Propodeum carinae conspicuously curved throughout all its extension; central part smooth and glabrous; lateral area uniformly pubescent and finely alutaceous. Nucha present, with longitudinal carinae; posteriorly margined.

Wings (Fig. 10a): Forewings 1.3–1.4x longer than body, hyaline, margins ciliate; radial cell 4x longer than broad; R1 not reaching anterior margin of forewing; Rs slightly projected; areola closed forming a triangle; Rs + M projection reaching in the half of basal vein.

Legs: Tarsal claws with a conspicuous tooth forming an acute angle.

Metasoma (Fig. 9a–b): As long as high and 1.3–1.4x longer than mesosoma in lateral view; second metasomal tergite covering more than half of metasoma, finely striated with discontinuous striae and smooth small areas, pubescent on lateral part of anterior half, pubescence not reaching margins of tergite, posterior margin smooth; rest of tergites reticulated with the distal margin smooth and shiny; ventral spine not projected posteriorly over metasoma, 2x longer than broad, incise distally and with sparse lateral setae on each side that project over the tip of the spine, not forming a tuft.

Gall (Fig. 10b): Adheres to the central nerve on the lower face of the rarely leaves on the lower face. It is presented as a mass of brown wool with circular-looking shape, with a non-brittle pubescence, 2.0–2.5 cm diameter. The pubescence is located above the central core forming a layer of 5–7 mm thick. The central polythalamous, light brown, dense and hard, without separating the larval chambers, which are slightly ovoid (1 × 1.5 mm). The number of larval cameras ranges from 7–15.

Biology: Only asexual females are known. The galls appear in August and the adults emerge in March.

Host: It occurs on *Quercus magnoliifolia* Née (section *Quercus*), endemic species from México.

Distribution: México (Jalisco).

DISCUSSION

Our results from the different molecular phylogenetic analyses gave identical tree topologies (20 taxa belonging to *Andricus*, *Biorhiza*, *Cynips*, *Disholcaspis*, *Dryocosmus*, *Plagiotrochus* and

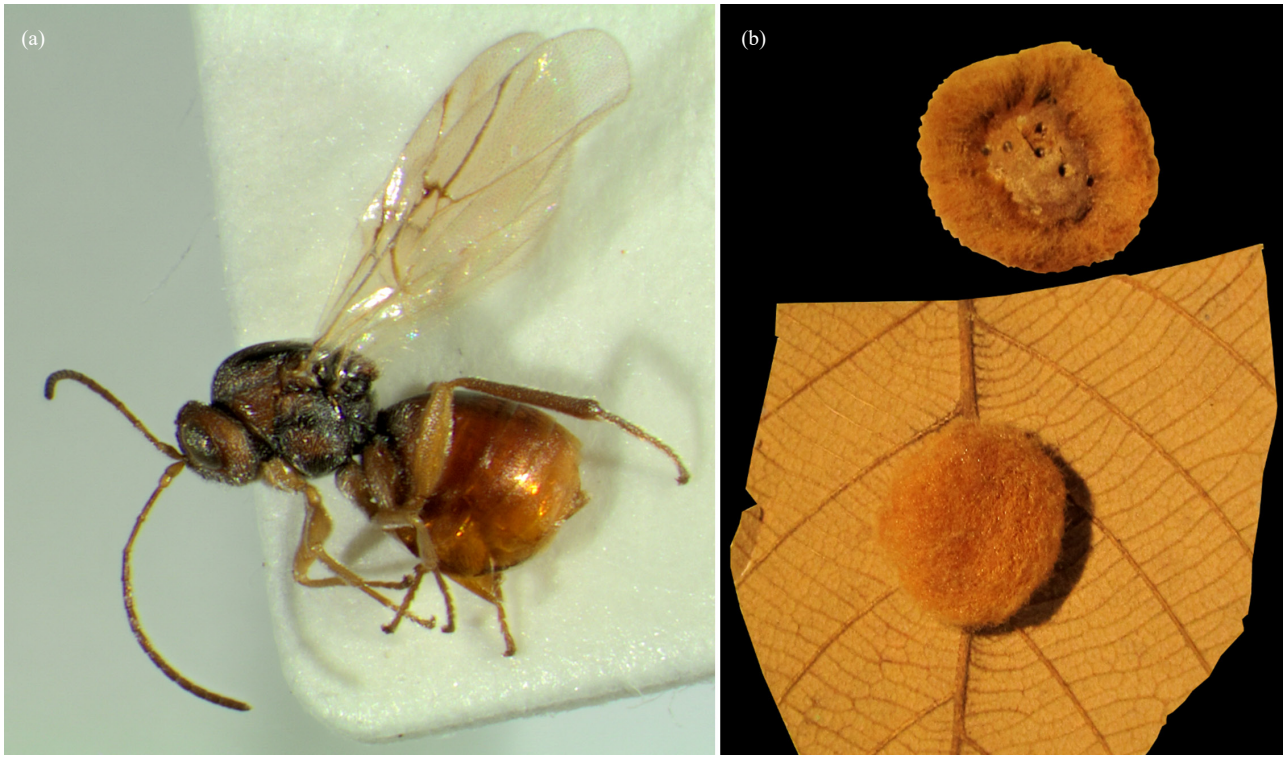

Fig. 10. *Striatoandricus sanchezi* n. sp.: (a) body, (b) gall with detail of fused larval chambers.

Trigonaspis genera). Nodal support was considerably higher in the results of the Bayesian phylogenetic analysis; thus, such results have better resolution and are shown as the results of this study. Results of the Bayesian phylogenetic analysis are summarised in the consensus tree (Fig. 11). Within the Cynipini, the genera *Plagiotrochus* and *Dryocosmus* are supported as monophyletic and sister to the remaining members of the tribe, which also form a well-supported clade. Within this latter clade, the species of the genus *Andricus* are recovered monophyletic with high support and sister to the remaining genera, which also form a clade, albeit with some low supported nodes. The *Andricus* species with sculptured metasoma (*Striatoandricus* gen. nov.) never appears in the *Andricus* clade.

Based on morphology, the species with sculpted metasoma included in this study in *Striatoandricus* gen. nov. have traditionally been considered closely related to *Andricus* (see Pujade-Villar et al. 2011; Pujade-Villar 2015). In fact, the first species bearing these traits described (Kinsey 1920) were included in *Andricus*. Molecular data do not support this hypothesis (Fig. 11).

The *Andricus* phylogeny is still a pending issue yet to be resolved, especially in America. The genus has appeared as para- or polyphyletic in previous morphological (Liljeblad 2002) and molecular studies (Ács et al. 2007, Ronquist et al. 2015). These evidences point towards the hypothesis of a complex of genera within *Andricus*. In this way, *Erythres* Kinsey, *Femuros* Kinsey and *Dros* Kinsey, considered synonymous of *Andricus*, have been recently re-established (see introduction), and three new genera (*Kinseyella* Pujade-Villar & Melika, *Melikaiella* Pujade-Villar and *Protobalandricus* Melika, Nicholls & Stone) have been described to include old American *Andricus* (= *Adleria*) species. Our results support the hypothesis that the species of *Andricus* with sculptured metasoma are not true *Andricus*. Thus, the erection of a new genus is consistent with both molecular and morphological data; therefore, those species are included here in *Striatoandricus* gen. nov. (Fig. 11). It is important to mention that our analysis only affirms that the species with sculptured metasoma are not true *Andricus* but we cannot affirm that the new genus is closely related to the clade including *Cynips*, *Trigonaspis* and *Biorhiza* genera; in fact, the relation of these genera with

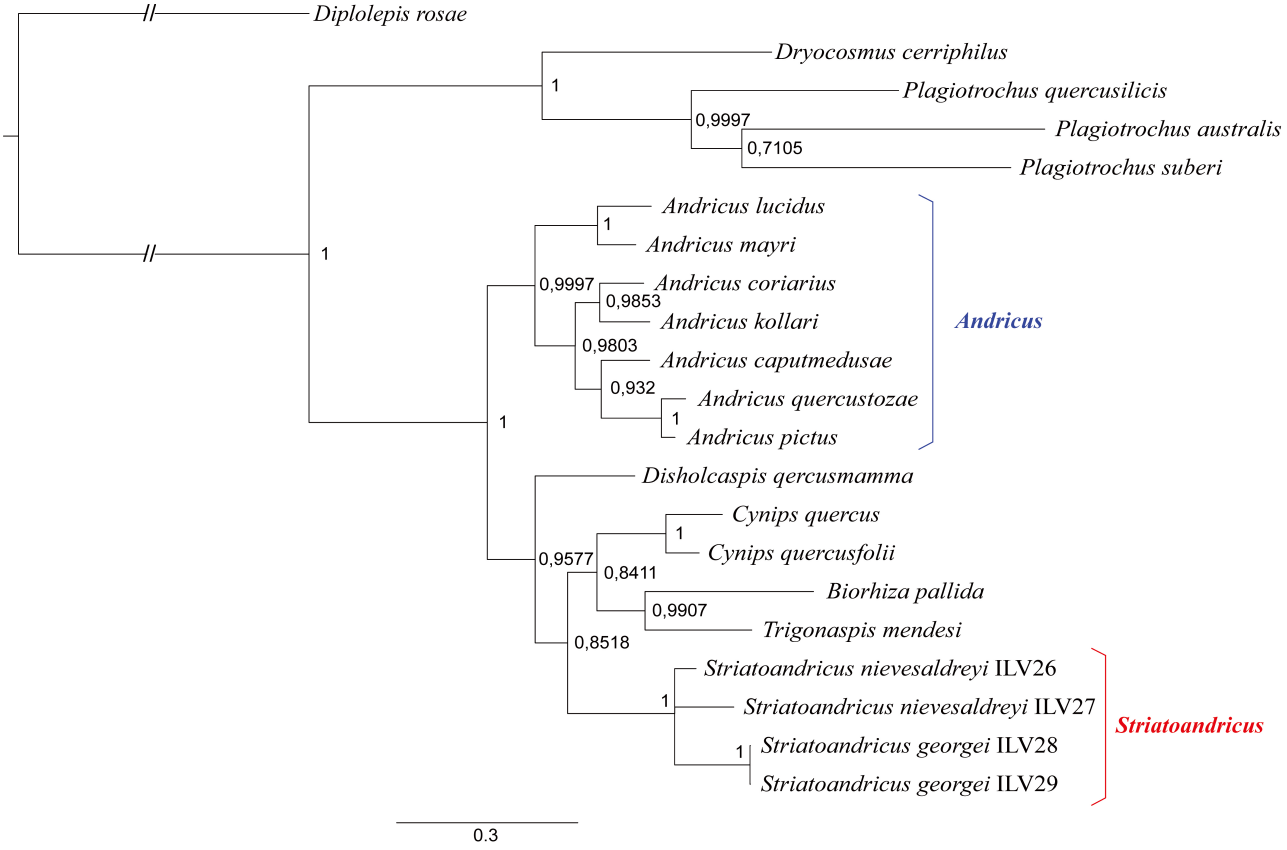

Fig. 11. Bayesian phylogenetic tree of Cynipini using three concatenated molecular markers (*COI*, cyt*b*, and 28S). Nodal supports are posterior probabilities. *Diplolepis rosae* (Dilolepidini) was set as the outgroup. The terminals belonging to *Andricus* (blue) and *Striatoandricus* (red) are highlighted. Explanations in the text (discussion).

Striatoandricus is poorly supported, then it is probable that this relation is not true, but with the genera included in this analysis, *Striatoandricus* gen. nov. appears in this clade and completely separated from *Andricus*. To solve the right position of *Striatoandricus* in Cynipini tribe a wider set of DNA sequences from American genera is needed.

Within *Striatoandricus*, there are two major morphological and biological species groups. The first includes *S. maesi* and *S. cuixarti*, which are generally black in colour, bear a pronotum striated laterally and a metasoma with fundamentally reticulate sculpture and a big smooth dorsal area; its galls have non-fused larval chambers. The second group includes *S. barriosi*, *S. georgei*, *S. nievesaldreyi* and *S. sanchezi*, which light specimens usually present black marks, bear a pronotum not striated laterally and a metasoma with fundamentally striated sculpture, but usually with a small smooth dorsal area or are completely sculptured; its galls have fused larval chambers forming a spherical mass under the pubescence.

Externally, *Striatonadricus* gen. nov. galls resemble to those of the *Andricus tecturnarum* group. This group of *Andricus* also form pubescent galls but, unlike *Striatoandricus*, their metasoma is not sculptured (at least in the specimens available for study and in the original description of *A. tecturnarum*). Nevertheless, the possibility that the species of the *Andricus tecturnarum* group are closely related to the *Striatoandricus* gen. nov. cannot be ruled out. Further phylogenetic analyses including representatives of this *Andricus tecturnarum* group will be required to test this last possibility.

CONCLUSIONS

In summary, based on morphological characters and molecular data (mitochondrial *COI*, cyt*b*, and nuclear 28S), the species in *Striatoandricus* (*S. barriosi*, *S. cuixarti*, *S. georgei*, *S. maesi*, *S. nievesaldreyi* and *S. sanchezi*) form a distinct monophyletic group and thus represent a distinct genus within the *Andricus*-like species in the Nearctic and Neotropical regions. There is no doubt that the current lineages within *Andricus* (unpublished data) do not reflect the generic diversity of oak gall-formers in America and probably also in the Palaearctic. We predict new re-establishments and undescribed genera in future revisions.

Acknowledgment: This work and the new species names have been registered with ZooBank under urn: lsid:zoobank.org:pub:2472C5B0-17B6-45F0-A5BB-4A7AE56D5D41. We are grateful to Alba Enguídanos García (University of Barcelona, Catalonia) for extracting, amplifying, and editing all the original DNA sequences from this study.

Authors' contributions: VCP wrote the manuscript and performed the molecular phylogenetic analyses; VCP and JPV designed the study, identified the study material and, described the new genus and species; MAA designed and supervised the molecular phylogenetic analyses, and revised the manuscript; UMBR, RDGM, AEM, EGEV, RCT captured the studied material and revised the manuscript; SRR identified all the *Quercus* species and revised the manuscript; JPV also revised the manuscript.

Competing interests: Víctor Cuesta-Porta, Miquel A. Arnedo, David Cibrián-Tovar, Uriel M. Barrera-Ruiz, Rosa D. García-Martiñón, Armando Equihua-Martínez, Edith G. Estrada-Venegas, Ricardo Clark-Tapia, Silvia Romero-Rangel, and Juli Pujade-Villar have no conflict of interests.

Availability of data and materials: All the studied material is deposited in either museums or public institutions. All the DNA sequences were either extracted from GenBank or have been submitted by the first author.

Consent of publication: Not applicable.

Ethics approval consent to participate: Not applicable.

REFERENCES

Ács Z, Melika G, Penzes Z, Pujade-Villar J, Stone GN. 2007. The phylogenetic relationships between *Dryocosmus*, *Chilaspis* and allied genera of oak gallwasps (Hymenoptera, Cynipidae: Cynipini). Syst Entomol **32(1):**70–80. doi:10.1111/j.1365-3113.2006.00351.x.

Bassett HF. 1890. New species of North American Cynipidae. T Am Entomol Soc (1890-) **17(1):**59–92.

Benson DA, Cavanaugh M, Clark K, Karsch-Mizrachi I, Lipman DJ, Ostell J, Sayers EW. 2012 GenBank. Nucleic Acids Research **41(D1):**D36–D42. doi:10.1093/nar/gks1195.

Cameron P. 1883. Hymenoptera Biology Centrali-America. Vol. 1., 497 pp., 120 pl.

Campbell B, Heraty J, Rasplus JY, Chan K, Steffen-Campbell J, Babcock C. 2000. Molecular systematics of the Chalcidoidea using 28S-D2 rDNA. Hymenoptera-Evolution, Biodiversity and Biological Control. CSIRO Publishing, Collingwood, pp. 59–73.

Dalla Torre KW, Kieffer JJ. 1910. *Cynipidae*. *In*: Das Tierreich. Vol. 24. Friedlander and Sohn, Berlin, pp. 1–891.

Folmer O, Black M, Hoeh W, Lutz R, Vrijenhoek R. 1994. DNA primers for amplification of mitochondrial cytochrome *c* oxidase subunit I from diverse metazoan invertebrates. Mol Mar Biol Biotech **3(5):**294–299.

Hall TA. 1999. BioEdit: a user-friendly biological sequence alignment editor and analysis program for Windows 95/98/NT. *In*: Nucleic acids symposium series (Vol. 41, No. 41, pp. 95–98). [London]: Information Retrieval Ltd., pp. c1979–c2000.

Harris R. 1979. A glossary of surface sculpturing. State of California, Department of Food and Agriculture, Occasional Papers in Entomology **28:**1–31.

Jermiin LS, Crozier RH. 1994. The cytochrome-*b* region in the mitochondrial DNA of the ant *Tetraponera rufonigerö* sequence divergence in hymenoptera may be associated with nucleotide content. J Mol Evol **38:**282–294. doi:10.1007/BF00176090.

Katoh K, Misawa K, Kuma KI, Miyata T. 2002. MAFFT: a novel method for rapid multiple sequence alignment based on fast Fourier transform. Nucleic Acids Res **30(14):**3059–3066. doi:10.1093/nar/gkf436.

Kinsey AC. 1920. New species and synonymy of American Cynipidae. B Am Mus Nat Hist **42:**293–317.

Kohnen A, Richter I, Brandl R. 2012. No concordant phylogeographies of the rose gall wasp *Diplolepis rosae* (Hymenoptera, Cynipidae) and two associated parasitoids across Europe. PLoS ONE **7(10):**e47156. doi:10.1371/journal.pone.0047156.

Kumar S, Stecher G, Tamura K. 2016. MEGA7: Molecular Evolutionary Genetics Analysis version 7.0 for bigger datasets. Mol Biol Evol **33(7):**1870–1874. doi:10.1093/molbev/msw054.

Lanfear R, Frandsen PB, Wright AM, Senfeld T, Calcott B. 2016. PartitionFinder 2: new methods for selecting partitioned models of evolution for molecular and morphological phylogenetic analyses. Mol Biol Evol **34(3):**772–773. doi:10.1093/molbev/msw260.

Lee Y, Kanturski M, Lee S. 2018. The *Mesocallis* Matsumura (Hemiptera: Aphididae) of the Korean peninsula with descriptions of two new species. Zool Stud **57:**17. doi:10.6620/ZS.2018.57-17.

Liljeblad J, Ronquist F. 1998. A phylogenetic analysis of higher-level gall wasp relationships (Hymenoptera: Cynipidae). Syst Entomol **23:**229–252. doi:10.1046/j.1365-3113.1998.00053.x.

McEwen C, Digweed S, Nicholls JA, Cranshaw W. 2014. Description and biology of the sexual generation of *Disholcaspis quercusmamma* (Walsh and Riley) (Hymenoptera: Cynipidae), with notes on associated parasitoids. P Entomol Soc Wash **116(3):**294–310. doi:10.4289/0013-8797.116.3.294.

Medianero E, Nieves-Aldrey JL. 2013. *Barucynips panamensis*, a new genus and species of oak gallwasps (Hymenoptera, Cynipidae, Cynipini) from Panama, and description of one new species of *Coffeikokkos*. ZooKeys **277:**25–46. doi:10.3897/zookeys.277.3942.

Medianero E, Nieves-Aldrey JL. 2019. *Andricus barriosi*: a new species of oak gall wasp (Hymenoptera: Cynipidae: Cynipini) from Panama. Zootaxa **4577(3):**585–595. doi:10.11646/zootaxa.4577.3.12.

Melika G. 2006. Gall Wasps of Ukraine. Cynipidae. Vestnik zoologii, supl **21(1–2):**1–300, 301–644.

Melika G, Abrahamson WG. 2002. Review of the World Genera of Oak Cynipid Wasps (Hymenoptera: Cynipidae: Cynipini). *In*: Melika G. and Thuróczy Cs. (Eds.), Parasitic Wasps: Evolution, Systematics, Biodiversity and Biological Control. Agroinform, Budapest pp. 150–190.

Miller MA, Pfeiffer W, Schwartz T. 2010. Creating the CIPRES Science Gateway for inference of large phylogenetic trees. Gateway Computing Environments Workshop (GCE) **2010:**1–8. Ieee. doi:10.1109/GCE.2010.5676129.

Nicholls JA, Melika G, Stone GN. 2017. Sweet tetra-trophic interactions: multiple evolution of nectar secretion, a defensive extended phenotype in cynipid gall wasps. The American Naturalist **189(1):**67–77. doi:10.1086/689399.

Nicholls JA, Stone GN, Melika G. 2018. A new genus of oak gallwasp, *Protobalandricus* Melika, Nicholls and Stone (Hymenoptera: Cynipidae: Cynipini) from California. Zootaxa **4472(1):**141–152. doi:10.11646/zootaxa.4472.1.7.

Nylander JA, Ronquist F, Huelsenbeck JP, Nieves-Aldrey J. 2004. Bayesian phylogenetic analysis of combined data. Syst Biol **53(1):**47–67. doi:10.1080/10635150490264699.

Pujade-Villar J. 2015. *Andricus maesi* n. sp. Primera especie de cinípido gallícola para Nicaragua (Hymenoptera: Cynipidae). Boletín de la Sociedad Entomológica Aragonesa **57:**39–44.

Pujade-Villar J, Cibrián-Tovar D, Cibrián-Llanderal VD, Equihua-Martínez A, Estrada-Venegas EG, Serrano-Muñoz M, Lomeli-Flores JR. 2014. A new genus of oak gallwasp, *Melikaiella* Pujade-Villar Hymenoptera: Cynipidae: Cynipini), from the Nearctic region. Dugesiana **21(1):**1–29.

Pujade-Villar J, Equihua-Martínez A, Estrada-Venegas EG, Melika G. 2013. A new genus of oak gallwasp, *Kokkocynips* Pujade-Villar and Melika gen. n., with a description of a new species from Mexico (Hymenoptera, Cynipidae). Acta Zoológica, Mexican, New Series **29(1):**209–218. doi:10.21829/azm.2013.291396.

Pujade-Villar J, Equihua-Martínez A, Estrada-Venegas EG, Serrano-Muñoz MJ, Lomeli-Flores R. 2011. Una nueva especie mexicana del género *Andricus* con caracteres muy peculiares: *A. georgei* Pujade-Villar n. sp. (Hymenoptera, Cynipidae). Boletín de la Sociedad Entomológica Aragonesa **49:**27–32.

Pujade-Villar J, Ferrer-Suay M. 2015. Adjudicació genèrica d'espècies mexicanes d'ubicació dubtosa descrites per Kinsey i comentaris sobre la fauna mexicana (Hymenoptera: Cynipidae: Cynipini). Butlletí de la Institució Catalana d'Història Natural **79:**7–14.

Pujade-Villar J, Ferrer-Suay M, Cuesta-Porta V, Lobato-Vila I. 2018. ¿Existe *Biorhiza* Westwood, 1840 (Hymenoptera: Cynipidae) en México? Folia Entomologica Mexicana (n. s.) **4(3):**110–127.

Pujade-Villar J, Hanson P, Medinas CA, Torres M, Melika G. 2012a. A new genus of oak gallwasps, *Zapatella* Pujade-Villar and Melika, gen. n., with a description of two new species from the Neotropics (Hymenoptera, Cynipidae, Cynipini). Zookeys **210:**75–104. doi:10.3897/zookeys.210.3014.

Pujade-Villar J, Hanson P, Melika G. 2012b. A new genus of oak gallwasp, *Coffeikokkos* Pujade-Villar and Melika, gen. n., with a description of a new species from Costa Rica (Hymenoptera, Cynipidae). Zookeys **168:**19–29. doi:10.3897/zookeys.168.2030.

Pujade-Villar J, Lobato-Vila I, Ferrer-Suay M. 2017. Restablecimiento del género *Dros* Kinsey (Hymenoptera: Cynipidae: Cynipini) como género válido para especies americanas. Entomología Mexicana **4:**752−758.

Pujade-Villar J, Melika G. 2014. Re-establishment of *Erythres* Kinsey, 1937 as a valid genus of gallwasps from Mexico (Hymenoptera: Cynipidae: Cynipini). Dugesiana **21(2):**155–160.

Pujade-Villar J, Romero-Rangel S, Chagoyán-Garcia C, Equihua-Martinez A, Estrada-Venegas EG, Melika G. 2010. A new genus of oak gallwasps, *Kinseyella* Pujade-Villar and Melika, with a description of a new species from Mexico (Hymenoptera: Cynipidae: Cynipini). Zootaxa **2335:**16–28. doi:10.11646/zootaxa.2335.1.2.

Rambaut A, Drummond AJ, Xie D, Baele G, Suchard MA. 2018. Posterior summarisation in Bayesian phylogenetics using Tracer 1.7. Syst Biol **67(5):**901–904. doi:10.1093/sysbio/syy032.

Ritchie AJ, Shorthouse JD. 1987. A review of the species of *Synergus* from Guatemala, with notes on *Cynips guatemalensis* Cameron (Hymenoptera: Cynipidae). P Entomol Soc Wash **89(2):**230–241.

Ronquist F. 1995. Phylogeny and early evolution of the Cynipoidea (Hymenoptera). Syst Entomol **20:**309–35. doi:10.1111/j.1365-3113.1995.tb00099.x.

Ronquist F. 1999. Phylogeny, classification and evolution of the Cynipoidea. Zool Scr **28:**139–164. doi:10.1046/j.1463-6409.1999.00022.x.

Ronquist F, Nieves-Aldrey JL, Buffington ML, Liu Z, Liljeblad J, Nylander JAA. 2015. Phylogeny, evolution and classification of gall wasps. The plot thickens. PLoS ONE **10(5):**1–40. doi:10.1371/journal.pone.0123301.

Ronquist F, Nordlander G. 1989. Skeletal morphology of an archaic cynipoid, *Ibalia rufipes* (Hymenoptera: Ibaliidae). Entomol Scand **33(Suppl):**1–60.

Ronquist F, Teslenko M, van der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP. 2012. MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. Syst Biol **61(3):**539–542. doi:10.1093/sysbio/sys029.

Rokas A, Atkinson RJ, Brown GS, West SA, Stone GN. 2001. Understanding patterns of genetic diversity in the oak gallwasp *Biorhiza pallida*: demographic history or a *Wolbachia* selective sweep? Heredity **87(3):**294–304. doi:10.1046/j.1365-2540.2001.00872.x.

Rokas A, Atkinson RJ, Webster L, Csóka G, Stone GN. 2003a. Out of Anatolia: longitudinal gradients in genetic diversity support an eastern origin for a circum-Mediterranean oak gallwasp *Andricus quercustozae*. Mol Ecol **12(8):**2153–2174. doi:10.1046/j.1365-294X.2003.01894.x.

Rokas A, Melika G, Abe Y, Nieves-Aldrey JL, Cook J M, Stone GN. 2003b. Lifecycle closure, lineage sorting, and hybridization revealed in a phylogenetic analysis of European oak gallwasps (Hymenoptera: Cynipidae: Cynipini) using mitochondrial sequence data. Mol Phylogenet Evol **26(1):**36–45. doi:10.1016/S1055-7903(02)00329-9.

Rokas A, Nylander JA, Ronquist F, Stone GN. 2002. A maximum-likelihood analysis of eight phylogenetic markers in gallwasps (Hymenoptera: Cynipidae): implications for insect phylogenetic studies. Mol Phylogenet Evol **22(2):**206–219. doi:10.1006/mpev.2001.1032.

Stamatakis A. 2006. RAxML-VI-HPC: maximum likelihood-based phylogenetic analyses with thousands of taxa and mixed models. Bioinformatics **22(21):**2688–2690. doi:10.1093/bioinformatics/btl446.

Stone GN, Atkinson R, Rokas A, Csóka G, Nieves-Aldrey JL. 2001. Differential success in northwards range expansion between ecotypes of the marble gallwasp *Andricus kollari*: a tale of two lifecycles. Mol Ecol **10(3):**761–778. doi:10.1046/j.1365-294x.2001.01211.x.

Stone GN, Cook JM. 1998. The structure of cynipid oak galls: patterns in the evolution of an extended phenotype. Proceedings of the Royal Society of London. Series B: Biological Sciences **265(1400):**979–988. doi:10.1098/rspb.1998.0387.

Stone GN, Hernandez-Lopez A, Nicholls JA, Di Pierro E, Pujade-Villar J, Melika G, Cook JM. 2009. Extreme host plant conservatism during at least 20 million years of host plant pursuit by oak gallwasps. Evolution: International Journal of Organic Evolution **63(4):**854–869. doi:10.1111/j.1558-5646.2008.00604.x.

Stone GN, Lohse K, Nicholls JA, Fuentes-Utrilla P, Sinclair F, Schönrogge K, Csóka G, Melika G, Nieves-Aldrey JL, Pujade-Villar J, Tavakoli M, Askew RR, Tavakoli M. 2012. Reconstructing community assembly in time and space reveals enemy escape in a Western Palearctic insect community. Curr Biol **22(6):**532–537. doi:10.1016/j.cub.2012.01.059.

Weld LH. 1952. Cynipoidea (Hym.) 1905–1950. Ann Arbor, Michigan, 351pp. [privately printed]

Whiting MF, Carpenter JC, Wheeler QD, Wheeler WC. 1997. The Strepsiptera problem: phylogeny of the holometabolous insect orders inferred from 18S and 28S ribosomal DNA sequences and morphology. Syst Biol **46(1):**1–68. doi:10.1093/sysbio/46.1.1.